NOVEMBER, 1960

# Plant Engineering®

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Volume 14, No. 11 Circulation of this issue 51,972

# Why SQUARE D ALUMINUM PLUG-IN DUCT?

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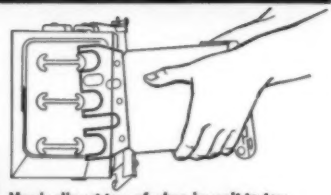
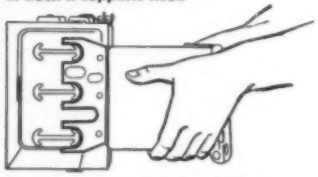
**PLUG-IN UNITS GIVE YOU EXCLUSIVE *hook-swing* MOUNTING**



Hook clip at top of plug-in unit to top of duct. It supports itself



Then, just swing plug-in unit down until jaws engage bus bars

**Hanger mounting** (*not shown*) makes installation easy. A universal hanger permits mounting in *any* position. Just suspend and level top portion of hanger, then clip on lower portion. U.L. approved for 10-foot spacing.

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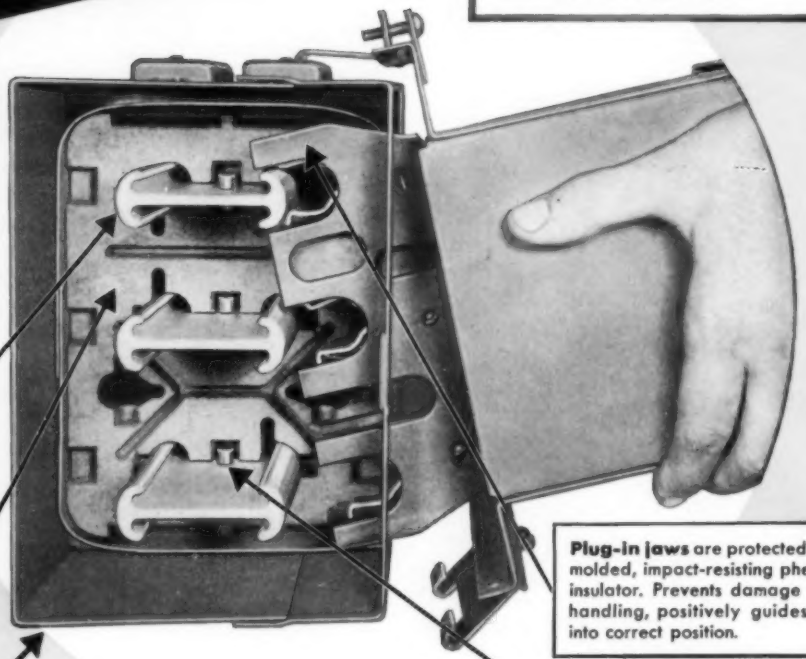
**Full width bus support** provides greater strength on short circuits, freedom from vibration. Also acts as fire stop where duct passes through walls and floors.

**Square D duct is totally enclosed** for maximum safety—no danger of accidental shorts. Prevents overheating from dust accumulation.



**Plug-in jaws** are protected by a molded, impact-resisting phenolic insulator. Prevents damage from handling, positively guides unit into correct position.

**Steel pins** in each bus bar prevent bars from shifting and support them on vertical riser installations.

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***Write for Bulletin SD-110. It gives the facts on Square D aluminum plug-in duct. Address Square D Company, Mercer Road, Lexington, Kentucky***

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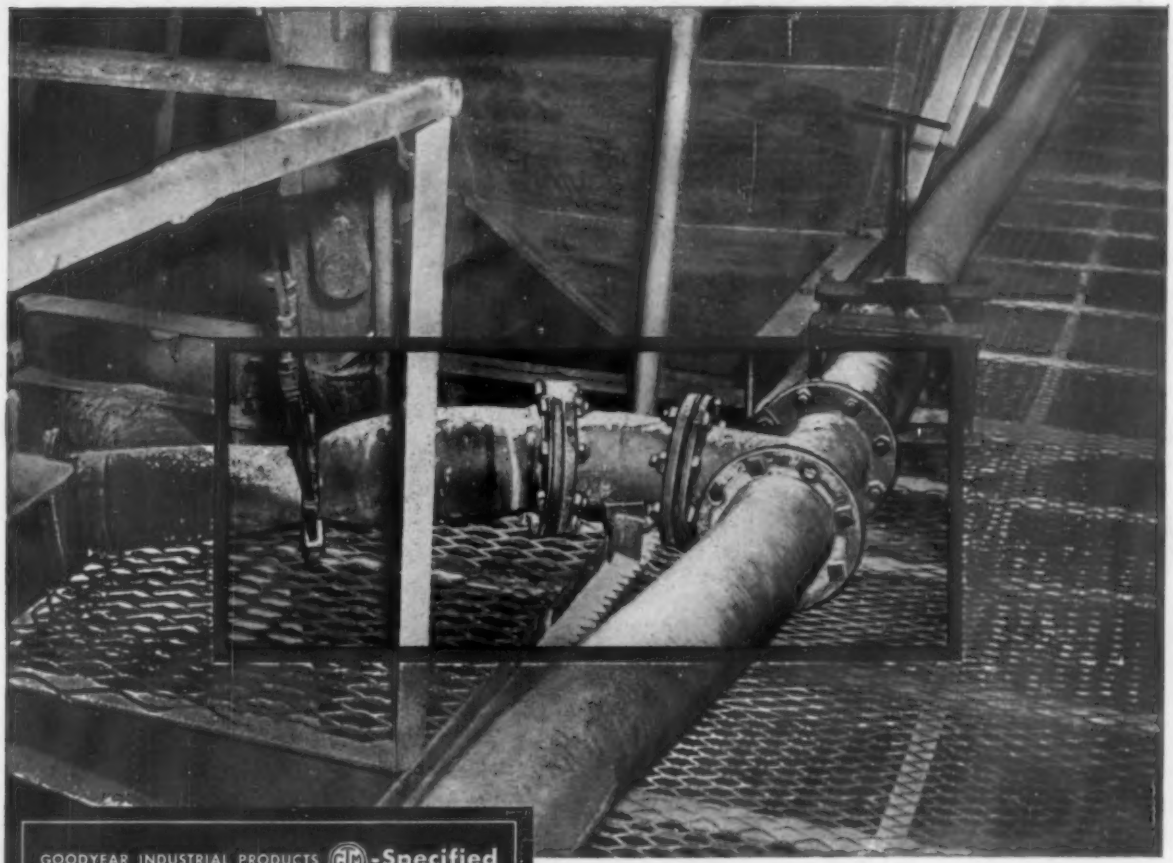
**It isn't often you make a 25%-35% maintenance saving** in a key operation. But the G.T.M.—Goodyear Technical Man—made it possible at a pumping operation of a Midwest mine. His recommendation: Diversipipe in place of short-lived iron pipe for the bulk of the slurry line. This rugged, flexible rubber pipe—along with special G.T.M.-specified pinch valve hose and rubber-lined fittings—now carries the murderously abrasive slurry throughout the processing plant. What's more, at last report, the Diversipipe, pinch valves and fittings had been handling this tough job for five full years and were still going strong.



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# 'ROUND ABOUT with the editors

*Edited by R. L. Marinello*

## Meet Our New President– Arthur L. Rice, Jr.

**Arthur L. Rice, Jr.,** has been elected president of Technical Publishing Company. He will fill the office left vacant by the recent death of his brother, Kingsley L. Rice.

After several years with Procter & Gamble Company in Cincinnati, he joined Technical Publishing Company

in 1945, becoming treasurer in 1947 and executive vice president a few months ago.

He holds a B.S. degree in industrial administration from the University of Illinois and is a member of Delta Upsilon and the Lions Club.

## Laboratory Facilities Available

METAL-WORKING firms who would like to explore the applicability of vacuum heat-treating, brazing, sintering or casting to their production processes can now test-try their ideas. Laboratory facilities have been established by the Vacuum Metallurgical Department of F. J. Stokes Corporation at their Philadelphia headquarters.

The facilities, which are being made available at a modest scale of laboratory service fees, include a vacuum heat-treating furnace, designed to operate at temperatures up to 2200 C; a precision casting vacuum furnace, with an ultimate capacity of 17 lb (steel measure); and a vacuum heat-treating furnace, with temperature up to 1850 F.

For more information about this service, address your inquiry to F. J. Stokes Corporation, 5500 Tabor Road, Philadelphia 20, Pa.

## Plant Maintenance and Engineering Conference

CHICAGO HAS BEEN selected as the site for the 1961 Plant Maintenance and Engineering Conference and Show. Dates of the show are January 23 to the 26; for the conference, January 23 to the 25. The show portion of the program will be held at the International Amphitheatre along with the morning sessions of the conference. Evening conference sessions will be held at the Palmer House.

Following is a brief outline of some of the papers which will be presented at the conference: The Plant Engineers' Responsibility for Building Design and Construction, Welding in Maintenance, Accounting for Maintenance Costs, Training Maintenance Employees, Plant Engineering in the Small Plant, Getting the Most out of Industrial Trucks and Batteries, Managerial Controls for Plant and Maintenance Engineers, and many others. A more detailed description of the papers and the names of the speakers will appear in a later issue.

If you wish to receive any specific information regarding the conference or show or put in your reservations for advance registration cards at this time, write to Clapp and Poliak, Inc., 341 Madison Ave., New York 17, N.Y.

## Visit Us at Booth 1019

EDITORS FROM PLANT ENGINEERING will be on hand at Booth 1019 at the Industrial Building Exposition and Congress. It will be held at the New York Coliseum from December 12 through the 15.

If you are planning to attend this conference and show, don't forget to stop at our booth. Should you wish to talk over any problem you may have or just to say "hello" and rest your feet, we'll be pleased to have you visit our booth during your tour of the show.

## Recommended Practices for Plant Emergencies

HERE IS A helpful pamphlet on the recommended practices and procedures for establishing emergency steps in an industrial plant. Although chemical plants are mentioned in particular, the majority of practices can also be applied to other types of industrial plants.

The four-page pamphlet notes that

*Subscriptions: U.S.A. $10, Canada $11. Other countries $12 per year. Single copies $1. Change of address: Send to PLANT ENGINEERING, Circulation Division, Barrington, Illinois. Please supply position title, company name, company address. Request must reach us by the 15th of month to make the change effective with following month's issue. Published monthly and accepted as controlled circulation publication at Chicago, Ill.*

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# 'ROUND ABOUT

an emergency plan should clearly define three basic objectives. They are:

1. A clear allocation and designation of responsibility to each of the necessary participating units or individuals.

2. The availability at all times of adequately trained personnel to discharge the designated responsibilities promptly and competently.

3. The immediate functioning of the various service units or individuals activated by the emergency plan when the emergency alarm is given.

Other points mentioned in this booklet are the establishment of an adequate communication system in the event normal communications channels are disrupted; development of an evacuation plan with responsibility assigned to those who would direct such an evacuation; coordination of plant activities with local law enforcement agencies; provision for maintenance of fire equipment facilities and fire fighting forces; preparation of a comprehensive repair and restoration program giving particular attention to shut down procedures in order to prevent further additional hazards or aggravation of emergency conditions; and the establishment of easily available medical centers for treatment of injured or disabled employees.

Copies of this emergency organization pamphlet, MCA Safety Guide (SG-4) are available from the Manufacturing Chemists' Association, Inc., 1825 Connecticut Ave., N.W., Washington 9, D. C., at 20 cents each.

## Plant Engineer Named President

**Craig L. Davis** was named president of Catawissa Valve and Fittings Company, Catawissa, Pennsylvania, at the firm's recent annual meeting of stockholders.

Davis joined the pipe union and valve manufacturer in 1946 as plant engineer. In recent years he has been the company's chief engineer. He had previously been connected with the hydraulics division of The Martin Co., Baltimore, Md.

## Standard on Fire Hoses

AN IMPORTANT new standard on fire hoses will be of interest to all industrial fire departments. It provides basic performance specifications to be used for purchasing woven-jacketed rubber-lined fire hose of single- or multiple-jacket construction.

The requirements standard applies to the trade sizes of 1, 1½ and 2½ in. single- or multiple-jacket, and 3 and 3½ in. multiple-jacket rubber-lined fire hose.

It includes sections on examination of hose for compliance, hose construction, diameter and length, hydrostatic pressure tests, mildew resistance and marking.

Copies of this new standard (NFPA No. 196, 16 pages) are available from the National Fire Protection Association, 60 Batterymarch St., Boston 10, Mass. The price of this standard is 40 cents per copy.

## We Goofed! Date Mix-up on Plant Engineering Workshop

IN THE SEPTEMBER issue this column incorrectly announced the dates of the Plant Engineering Workshop at the University of Wisconsin. The correct dates are Thursday and Friday, December 8 and 9.

As in previous seminars, talks will be presented by the men who know what plant problems can cause the most trouble and what to do about them—the plant engineers. This year's program is planned to help you do a better job in your plant.

For more information about the seminar or to place your reservation, write to Robert Loetscher, Institute Coordinator, University of Wisconsin, University Extension Division, Department of Engineering, Madison 6, Wisconsin.

## All Engineers Luncheon

PLANT ENGINEERS planning to attend the 1961 Plant Maintenance and Engineering Conference and Show will want to include the All Engineers Luncheon on their program. The luncheon will be held on Tuesday, January 24, at the Saddle and Sirloin Ballroom, Stock Yard Inn, Chicago, Illinois, beginning at 1:00 p.m.

In addition to getting together with old friends, you will have an opportunity to meet the officers and many members of the American Institute of Plant Engineers, the organization sponsoring the luncheon. A prominent speaker, as yet unannounced, will highlight the luncheon.

PLANT ENGINEERING will present complete information on the luncheon program in the December issue.

Your ticket, which will be $5.00 this year, will also admit you to the cocktail hour being sponsored by Allis-Chalmers Manufacturing Co., which will begin at 12:00 noon.

To get your reservation in early, send your request for the number of tickets desired to Henry J. Seither, Jr., International Harvester Co., 1015 W. 120th St., Chicago 43, Illinois.

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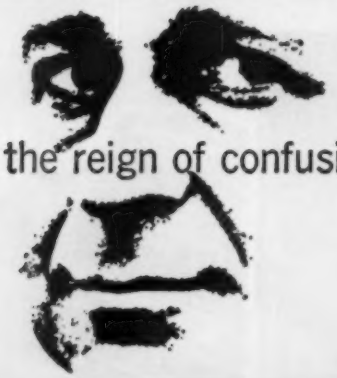
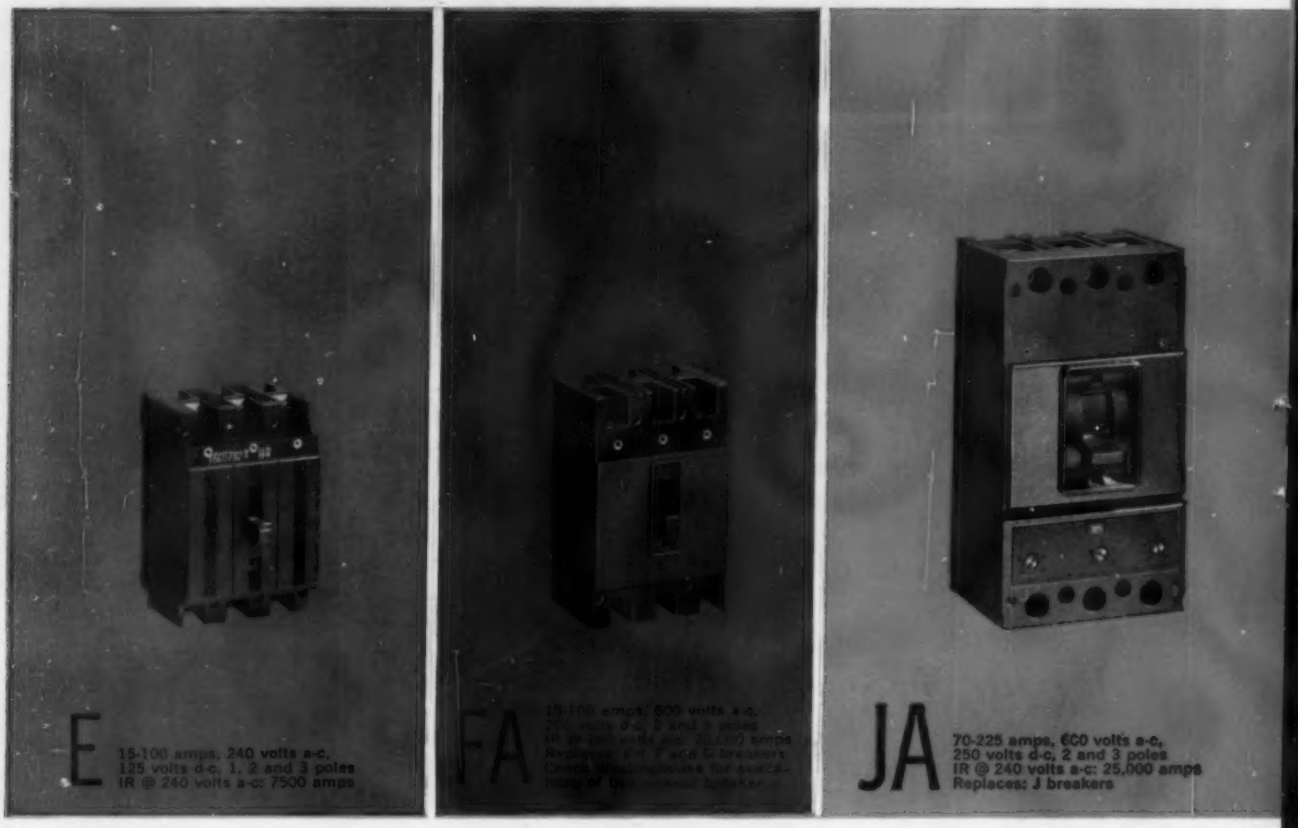


the reign of confusion is over


E
15-100 amps, 240 volts a-c,
125 volts d-c, 1, 2 and 3 poles
IR @ 240 volts a-c: 7500 amps
FA
JA
70-225 amps, 600 volts a-c,
250 volts d-c, 2 and 3 poles
IR @ 240 volts a-c: 25,000 amps
Replaces: J breakers

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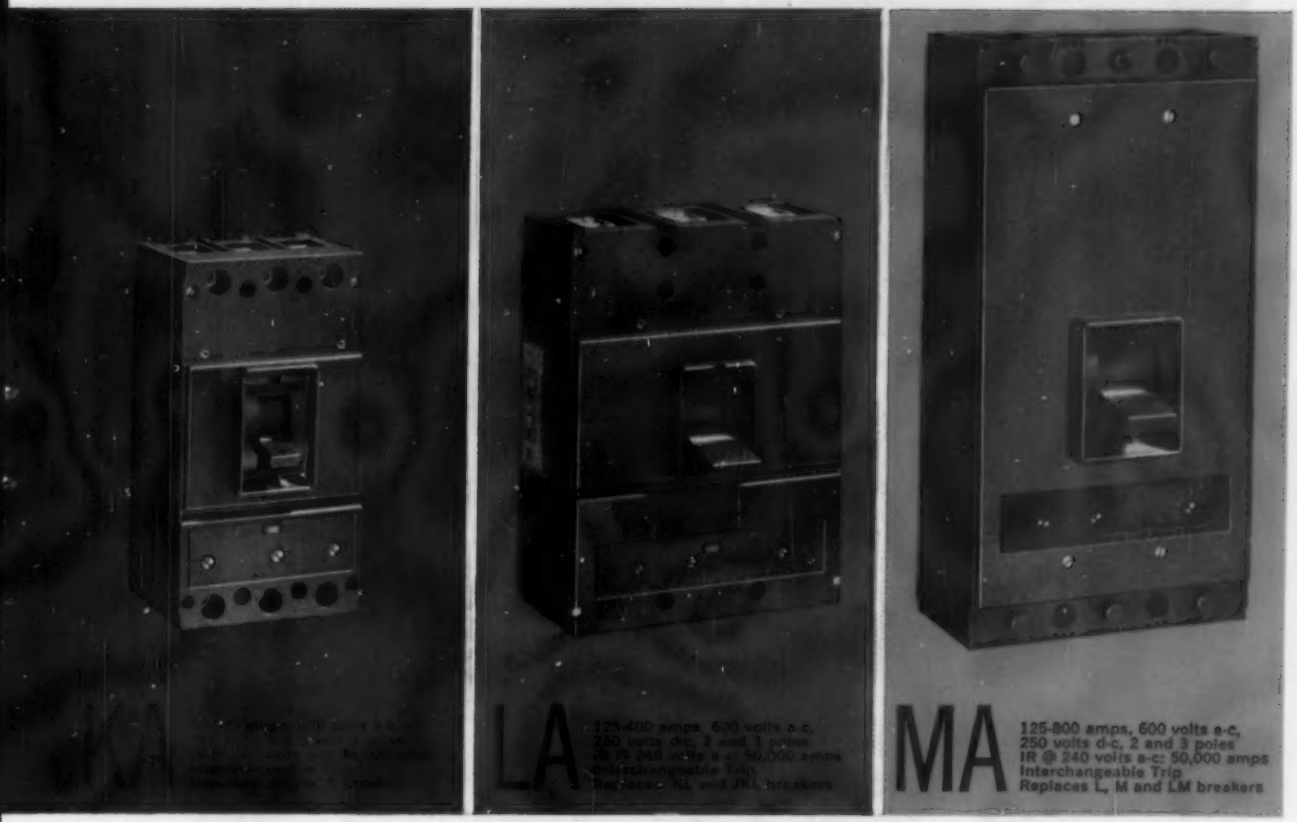
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Fusetron dual-element fuses meet todays' demand for safety. They have an interrupting rating of 100,000 ampere rms symmetrical — and for protection of mains or circuits above 600 amperes, BUSS Hi-Cap fuses are designed to safely interrupt 200,000 ampere rms symmetrical.

And fuses remain safe and accurate through the years. They require no expensive maintenance or recalibration — they are always ready to function the instant trouble occurs.

*For more information on:*

**Buss FUSTAT fuses** . . . . . *write for bulletin SCPS*
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HELPFUL WATER CONDITIONING DATA FROM BETZ

# CORROSION CONTROL FOR

**The modern tools of corrosion control can reduce repair and maintenance costs in your boiler plant.**

CORROSION in the modern boiler plant can manifest itself in many locations; such as in the pre-boiler equipment, in the boilers and in the steam and condensate systems. Figures 1, 2 and 3 are typical illustrations of the damage done at some of these locations.

For the most part corrosion is due to dissolved oxygen. Other factors such as low pH values, carbon dioxide and ammonia may be involved, either alone or in conjunction with dissolved oxygen. The preventive measures required to adequately control corrosion involve mechanical equipment and/or chemical treatment.

## Mechanical Deaeration

The first line of defense in preventing corrosion is mechanical deaeration. As applied to boiler feedwater, this involves removal of dissolved oxygen in a vented heater by intimately mixing, scrubbing and heating the water with steam. The feedwater heater removes dissolved oxygen, decreases free carbon dioxide and elevates the feedwater to the saturation temperature of the steam. Since exhaust steam is used whenever available, boiler efficiency is also improved. Complex heater designs are required to secure maximum mechanical deaeration. The types of heaters employed include:

1. The *conventional open heater* is most frequently employed in the low pressure boiler plant and is designed to decrease dissolved oxygen to a range of 0.1-0.3 cc per liter.
2. The *deaerating heater* is a unit designed to decrease dissolved oxygen to concentrations of 0.03 cc per liter.
3. The *deaerator* is a unit designed to decrease dissolved oxygen to 0.005 cc per liter or less.

In plants that use simple receivers or open tanks in place of specially designed feedwater heaters, substantial amounts of dissolved oxygen will remain in the feedwater. For example, at atmospheric pressure and temperatures of 120 F, 150 F and 180 F, residual dissolved oxygen concentrations expected are 5.7, 4.3 and 1.5 ppm respectively. It is important therefore to maintain the feedwater temperature as high as possible for maximum removal of dissolved oxygen. The supplemental use of a chemical deaerant is essential in these plants to control corrosion and pitting due to dissolved oxygen. A second essential requirement is that the feedwater temperature be maintained at a consistently high level. Wide fluctuations in feedwater temperature would make it difficult, if not impossible, to regulate the feed of the chemical deaerant to cope with the varying concentrations of residual oxygen.

*Figure 1—Pitting in boiler drum.*

## Chemical Deaeration

Sodium sulfite is the chemical agent favored for chemical deaeration in all but the high pressure plants because of its low cost and ease of handling. Where speed of reaction is important a catalyzed sodium sulfite is available which will react instantaneously with dissolved oxygen. The reaction of sodium sulfite with dissolved oxygen is illustrated as follows:

$$2Na_2SO_3 + O_2 = 2Na_2SO_4$$

sodium sulfite + oxygen = sodium sulfate

To remove 1.0 ppm of dissolved oxygen approximately 10 ppm of technical grade sodium sulfite is required. The end product is sodium sulfate which adds to the dissolved solids content of the water, but is otherwise innocuous.

While chemical deaeration is essential where incomplete mechanical deaeration of the feedwater is accomplished, it is a much desired supplement even when employing specially designed feedwater heaters. The low additional cost of the chemical deaerant in these cases is justified as it provides:

1. Complete oxygen removal.
2. An added safety factor in the event of momentary interruptions in efficiency of mechanical deaeration.
3. Warning when the efficiency of mechanical deaeration is continuously low.
4. Protection of the pre-boiler equipment, such as feed pumps, feedlines, stage heaters and economizers.

*Figure 2—Condensate line attack by carbon dioxide.*

In many plants, the most suitable point of application is the storage compartment of the feedwater heater. In other plants, sufficient reaction time may be available with continuous feed to the suction side of the boiler feed pump.

As boiler operating pressures have increased, two disadvantages of sodium sulfite as a chemical deaerant have become evident. While the increase in dissolved solids produced by the end product sodium sulfate is of little consequence in low or medium pressure boilers, it can be of significance in high pressure boilers. Also, at high pressures, the residual sulfite required for control

purposes, tends to decompose to form the acidic gases, sulfur dioxide and hydrogen sulfide which can contribute to corrosion in the steam and condensate systems. For these reasons, hydrazine finds favor as a chemical deaerant in high pressure boiler systems. Hydrazine removes dissolved oxygen in accordance with the following reaction:

$$N_2H_4 + O_2 = 2H_2O + N_2$$
hydrazine + oxygen = water + nitrogen

Since the products of this reaction are water and nitrogen no dissolved solids are added to the boiler water. In addition, the decomposition products of the residual hydrazine are ammonia and nitrogen. The ammonia is alkaline and will not attack steel. However, it is essential to avoid high residuals of hydrazine otherwise the ammonia produced may have an adverse effect on copper and copper bearing alloys.

Except for special cases of corrosive attack involving high pressure boiler operation, experience has shown that it is desirable to maintain a minimum boiler water pH of approximately 10.5. This pH is sufficiently high to prevent corrosion of the boiler proper. Usually, in the low and moderate pressure range, boiler water alkalinity is set at sufficiently high levels primarily to assure the proper environment for precipitation of calcium and magnesium sludge. These levels assure at least the minimum pH necessary for proper protection of the boiler against acidic corrosion.

In high pressure boilers the alkalinity level is restricted to avoid "free caustic" and thus prevent embrittlement and other adverse effects.

Carbon dioxide has little bearing on corrosion of the pre-boiler system or the boiler proper. Efficient mechanical deaeration will decrease the free carbon dioxide of the boiler feedwater and as a result the pH of the feedwater will increase. The increase in pH thus produced together with the feed of a chemical deaerant usually affords adequate protection to the pre-boiler system. In some cases, the supplemental feed of caustic soda may be employed to further increase the pH of the feedwater and to speed the reaction of the chemical deaerant.

The concern with carbon dioxide is primarily due to its adverse effect in the steam and condensate system. The natural bicarbonate alkalinity of the feedwater decomposes when subjected to boiler temperature, yielding carbon dioxide which leaves the boiler with the steam. At points of condensation low pH will develop from the carbonic acid formed and corrosion will ensue. Prevention of steam and condensate corrosion can effectively and economically be accomplished by use of the film forming or neutralizing amines.

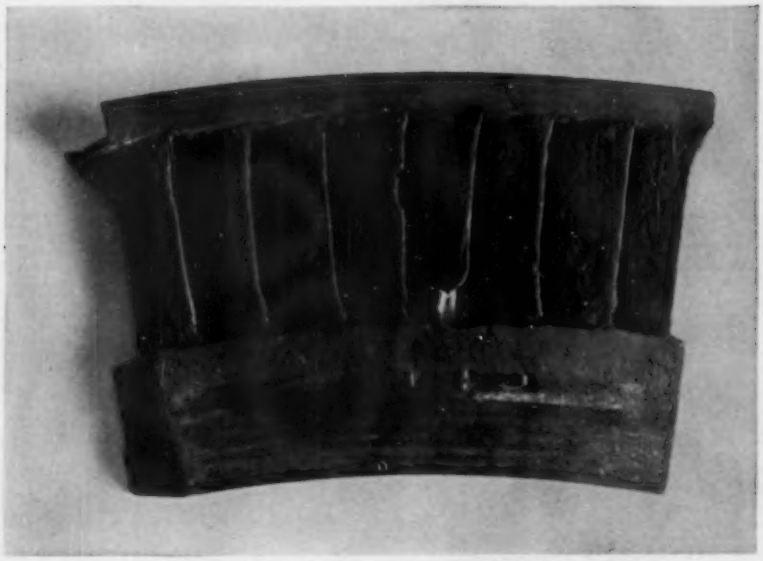


*Figure 3—Corrosion of turbine blades.*

## Other Factors

While mechanical and chemical deaeration will serve to cope with dissolved oxygen—the major cause of corrosion in boiler plants—pH and carbon dioxide are factors that must also be considered.

## Protection of Idle Equipment

All too often, little attention is given to idle equipment in the boiler plant until serious corrosion has developed. Special measures are necessary to protect idle boilers and steam turbines. The methods applicable depend on many factors but suitable procedures can be worked out for most conditions.

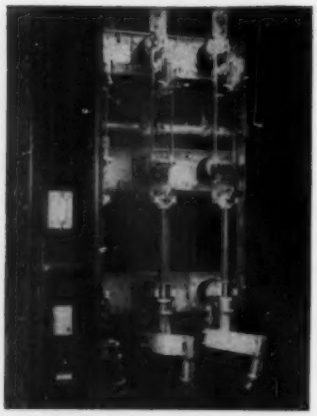
Betz Laboratories has pioneered in the development and practical application of many boiler corrosion prevention techniques. With an extensive background of experience in this field, we are ready to help solve your particular problem effectively and economically. A Betz Field Engineer will be happy to call on you, without obligation.

**BETZ LABORATORIES, INC.**
Gillingham & Worth Streets • Phila. 24, Pa.

BETZ

CONSULTANTS ON INDUSTRIAL WATER PROBLEMS

# SEES ALL YOUR FAULTS



Inside view of typical bay, showing load interrupter (for switching), power fuses, and out-going pothead.

# A Power Fuse both senses and clears short circuits— cuts cost of metalclad switchgear 50%

With S&C Metalclad Switchgear you get dependable protection for your high-voltage power circuits at about half the cost. How? Partly through the use of S&C Power Fuses instead of circuit breakers and relaying.

The power fuse is self-sufficient. It needs no instrument transformers, no relay. There is nothing to set, adjust, test, or maintain. You don't need special equipment or skills. After the fuse clears the fault and the cause has been corrected, you simply reach for a $13.50 refill stored in the compartment door.

Power fuses give you the protection you need against permanent destructive faults. Industrial and commercial high-voltage power circuits are not subject to transient faults (such as lightning, falling trees, wind, ice, rodents) and so don't need the automatic reclosing feature of the circuit breaker.

S&C fused interrupter gear meets the new National Electrical Code requirements for fault closing. It is available in short circuit interrupting ratings up to 500 mva at 14.4 kv, 250 mva at 4.16 kv. Continuous current ratings are 200, 400, and 720 amperes. Maximum capacity of main bus, 2000 amperes.

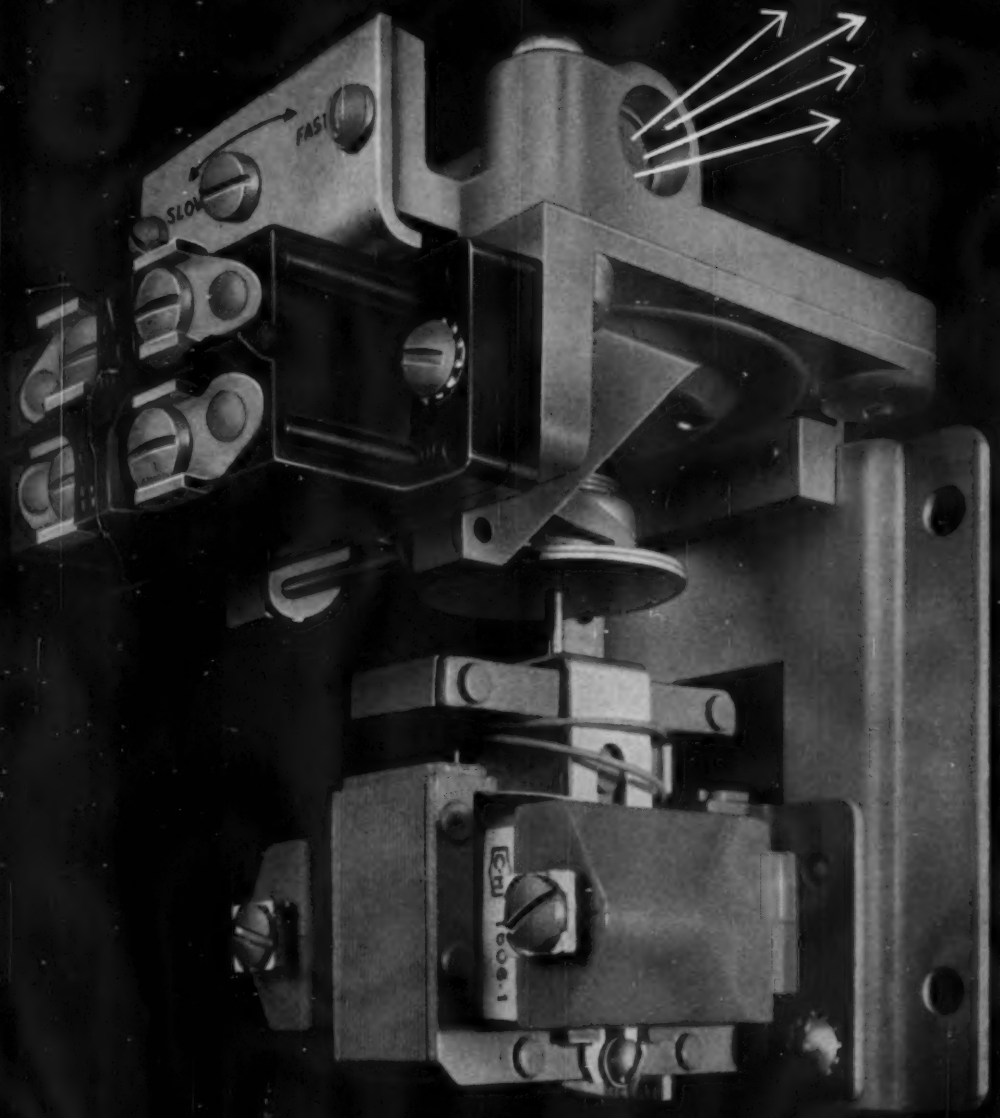
## S & C ELECTRIC COMPANY

**4423 Ravenswood Avenue • Chicago 40, Illinois**

**Specialists in High Voltage Circuit Interruption since 1911**

**For more facts circle 509 on Reply Card**

**NO CHECK VALVE!** Air cleans filter as it exhausts through the vent. No check valve to clog and cause trouble.




## EXPLODED VIEW SHOWS HOW NEW DIAPHRAGM DESIGN ELIMINATES CHECK VALVE

# New! A Cutler-Hammer one-minute pneumatic timer that eliminates the troublesome check valve!

***Unique diaphragm design makes timer more accurate and dependable than any other***

The new Cutler-Hammer one-minute Pneumatic Timer, by eliminating the conventional check valve, does away with failures caused by dust.

Using a silicone diaphragm, this timer pulls fresh air in through a filtered vent, and on the exhaust stroke blows away any dust that may have collected on the surface of the filter. No chance for dust to affect accurate timing or make the timer inoperable. The silicone diaphragm works equally well 150°F above zero or 45°F below zero.

No other timer is more accurate. It adjusts easily from .2 seconds to 60 seconds with a 7½-turn screw that provides precise adjustment to the desired time setting. All you need is a screwdriver. And, it can be changed from "on delay" to "off delay" in seconds. Smallest electrical dimensions of any one-minute timer, too. Call your Cutler-Hammer distributor for full details or send for Publication L071-W274.

**What's new at Cutler-Hammer?**

You can see the big change at Cutler-Hammer wherever you look. New, better products. New, expanded engineering staff and facilities. New added plant capacities. All done to help you meet the big opportunities of this decade.

If you're planning ahead, we'd like to show you how our talents and experience in electrical control could help you. Contact the nearest Cutler-Hammer sales office.

*WHAT'S NEW? ASK...*

**CUTLER-HAMMER**

Cutler-Hammer Inc., Milwaukee, Wisconsin • Division: Airborne Instruments Laboratory • Subsidiary: Cutler-Hammer International, C. A. Associates: Canadian Cutler-Hammer, Ltd.; Cutler-Hammer Mexicana, S. A.

**For more facts circle 510 on Reply Card**

# See why ALCOA ALUMINUM makes a good design habit

## **Requirement:** Simple, low-cost heated lines to pipe high viscosity fluids
## **Key to Good Design:** Specify UNITRACE and DUOTRACE, Alcoa's extruded aluminum pipes with integral steam chambers

With the development of UNITRACE® Piping, ALCOA created an entirely new technique for piping viscous fluids. Trace and product chamber are extruded in a single unit of light, strong, corrosion-resistant ALCOA® Aluminum. This integral steam-traced pipe eliminates the need for cumbersome, costly, inefficient pairing of separate pipes for steam and product. The resultant savings in initial cost are coupled with a major increase in the efficiency of heat application to the product piped.

Subsequent development of special flanges, elbows, adapter flanges and UNITRACE Trace Caps has made it possible to design and install completely integrated UNITRACE piping systems . . . compatible with standard piping components.

Now ALCOA has developed a new product, DUOTRACE,* to expand the design range of integrally traced piping systems. DUOTRACE contains not one but *two* trace chambers plus a product chamber in a single extruded aluminum pipe. This makes DUOTRACE the perfect solution to the need for recirculating tracing systems.

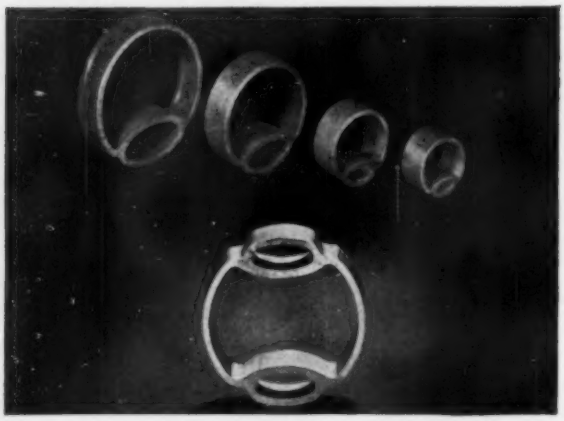
*Trademark of Aluminum Company of America

Today, the ingenuity of process industries designers has indicated intriguing new areas of potential use for both UNITRACE and DUOTRACE. Consider, for instance, the process economies which can result from the substitution of either UNITRACE or DUOTRACE for unit heat exchangers and preheaters.

Here you see an outstanding example of the way in which ALCOA is putting over 40 years of process industries experience to work to make aluminum your good design habit. You are invited to share that experience—through a series of engineering conferences which ALCOA is holding this year in a number of major cities. Your local ALCOA sales office will be happy to furnish details.

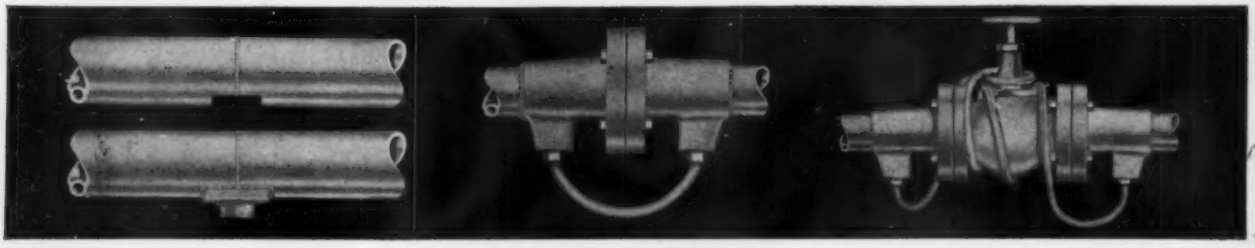
Take advantage, too, of the body of ALCOA literature which describes in technical detail the known performance characteristics of aluminum in a variety of process industries applications. Simply fill in and mail the coupon opposite. ALUMINUM COMPANY OF AMERICA, Alcoa Building, Pittsburgh 19, Pa.

World wide sales through ALCOA INTERNATIONAL, INC., 230 Park Avenue, New York 17, N.Y.

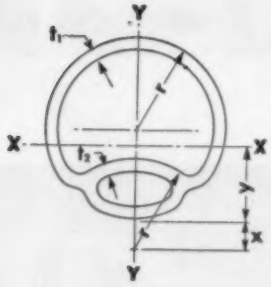


**The development of DUOTRACE** has opened broad new areas of design exploration in the field of heat transfer. By adding a second trace chamber to the one previously available in UNITRACE, DUOTRACE permits recirculation of the trace fluid. This opens up a whole new area of heat transfer design. Not the least of the possibilities is this: certain types of heat exchangers may now be extruded as single units. The cost savings implicit in such a unit are almost staggering. Alcoa engineers will be happy to assist you in exploring such design innovations in your own plant or process.

**Fittings and connections for UNITRACE and DUOTRACE: Unflanged connections** can be made easily and effectively with the special UNITRACE Trace Cap. As illustrated, trace chambers in adjoining sections are cut back and a circumferential weld is made to seal the product chamber. The cut back trace section is then covered with a UNITRACE Trace Cap welded in place with 4043 weld wire. Simple, efficient **flanged connections** utilize special UNITRACE flanges designed to accommodate both trace and product chambers. Jumper connections are used to carry the trace across the connection, and special impingement plates in the flange shield the product chamber from erosion as steam passes through the flange. **Valves, pumps and other fittings** can be incorporated into the traced systems by using UNITRACE flanges which mate with all 150-lb ASA flanges, valves and pumps. UNITRACE and DUOTRACE systems accommodate standard preformed pipe insulation.

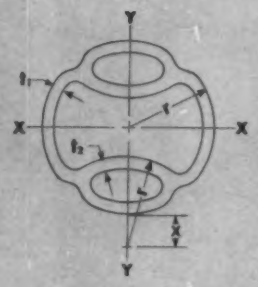


UNFLANGED CONNECTIONS | FLANGED CONNECTIONS | VALVES AND FITTINGS




| | Unitrace Sizes | 1 in. | 1½ in. | 2 in. | 3 in. | 4 in. | 6 in. | 8 in. |
|---|---|---|---|---|---|---|---|---|
| Axis XX | Moment of Inertia (I) in.⁴ | .09 | .34 | .72 | 2.71 | 6.52 | 31.82 | 81.82 |
| | Radius of Gyration (R) in. | .37 | .58 | .72 | 1.09 | 1.42 | 2.12 | 2.78 |
| | Section Modulus (S) in.³ | .13 | .34 | .56 | 1.42 | 2.65 | 8.73 | 17.22 |
| Axis YY | Moment of Inertia (I) in.⁴ | .09 | .33 | .70 | 2.65 | 6.36 | 29.72 | 76.70 |
| | Radius of Gyration (R) in. | .37 | .57 | .71 | 1.08 | 1.40 | 2.05 | 2.69 |
| | Section Modulus (S) in.³ | .14 | .34 | .59 | 1.52 | 2.83 | 8.97 | 17.79 |

| Sizes | 1 in. | 1½ in. | 2 in. | 3 in. | 4 in. | 6 in. | 8 in. |
|---|---|---|---|---|---|---|---|
| r | .657 | .950 | 1.187 | 1.750 | 2.250 | 3.312 | 4.312 |
| $t_1$ | .133 | .145 | .154 | .170 | .187 | .280 | .322 |
| $t_2$ | .145 | .163 | .174 | .185 | .200 | .307 | .354 |
| x | .133 | .344 | .406 | .625 | .813 | 1.500 | 2.000 |
| y | .61 | .87 | 1.08 | 1.59 | 2.03 | 2.98 | 3.87 |




| | Duotrace Sizes | 1 in. | 1½ in. | 2 in. | 3 in. | 4 in. | 6 in. | 8 in. |
|---|---|---|---|---|---|---|---|---|
| Axis XX | Moment of Inertia (I) in.⁴ | — | — | .80 | 3.06 | 7.53 | — | — |
| | Radius of Gyration (R) in. | — | — | .74 | 1.12 | 1.46 | — | — |
| | Section Modulus (S) in.³ | — | — | .68 | 1.75 | 3.35 | — | — |
| Axis YY | Moment of Inertia (I) in.⁴ | — | — | .67 | 2.59 | 6.29 | — | — |
| | Radius of Gyration (R) in. | — | — | .68 | 1.03 | 1.33 | — | — |
| | Section Modulus (S) in.³ | — | — | .57 | 1.48 | 2.80 | — | — |

| Sizes | 1 in. | 1½ in. | 2 in. | 3 in. | 4 in. | 6 in. | 8 in. |
|---|---|---|---|---|---|---|---|
| r | — | — | 1.187 | 1.750 | 2.250 | — | — |
| $t_1$ | — | — | .154 | .170 | .187 | — | — |
| $t_2$ | — | — | .174 | .185 | .200 | — | — |
| x | — | — | .531 | .843 | 1.125 | — | — |
| y | — | — | — | — | — | — | — |

| Unitrace-Duotrace Sizes | 1 in. | 1½ in. | 2 in. | | 3 in. | | 4 in. | | 6 in. | 8 in. |
|---|---|---|---|---|---|---|---|---|---|---|
| Product Area (in.²) | .64 | 1.68 | 2.72 | 2.36 | 6.38 | 5.67 | 10.84 | 9.74 | 24.64 | 42.79 |
| Trace Area (in.² each) | .10 | .16 | .35 | .22 | .98 | .61 | 1.86 | 1.07 | 2.85 | 5.12 |
| Metal Area (in.²) | .65 | 1.03 | 1.39 | 1.46 | 2.28 | 2.46 | 3.24 | 3.53 | 7.05 | 10.60 |
| Weight (lb/ft) | .77 | 1.22 | 1.66 | 1.72 | 2.71 | 2.89 | 3.85 | 4.16 | 8.38 | 12.60 |
| *Min. Bend Radii (in.) | 5 | 8 | 10½ | 10½ | 17 | 17 | 24 | 24 | 36 | 48 |
| Wetted Perimeter (in.) | | | | | | | | | | |
| Product | 3.35 | 4.92 | 6.31 | 6.28 | 9.68 | 9.65 | 12.72 | 13.02 | 18.63 | 24.75 |
| Trace (each) | 1.49 | 1.71 | 2.40 | 1.87 | 4.13 | 3.22 | 5.32 | 4.23 | 6.75 | 9.63 |
| Fitting Weights (lb) | | | | | | | | | | |
| Trace-Caps | .102 | .126 | .240 | .13 | .464 | .40 | .674 | .55 | 1.67 | 2.92 |
| Elbows | .706 | 1.347 | 2.111 | 2.65 | 5.244 | 6.59 | 9.649 | 11.68 | 27.76 | 52.51 |
| Impingement Plates | .024 | .039 | .057 | | .101 | | .162 | | .22 | .34 |
| Stub Ends | | | | .65 | | 1.50 | | 2.13 | | |
| Terminal Casting | | | | .50 | | 1.12 | | 1.75 | | |

| | 1–2 in. | 1½–2½ in. | 2–3 in. | 3–4 in. | 4–6 in. | 6–8 in. |
|---|---|---|---|---|---|---|
| Adapter Flanges | 2.419 | 3.816 | 4.774 | 7.216 | 11.106 | 19.23 |

(Note: UNITRACE values are indicated in clear areas in the table above. DUOTRACE values are shown in the shaded areas.)
*Unitrace may be bent in any direction to these radii provided reasonable tooling is employed.


Aluminum Company of America, 867-L Alcoa Building, Pittsburgh 19, Pa.
Please send me the following literature covering Alcoa Aluminum for tubular products and other uses in the process industries:

- ☐ 10197 Aluminum Pipe and Fittings
- ☐ 10418 Alcoa Unitrace: Combines Piping and Tracing in One Unit
- ☐ 514 Alcoa Duotrace Technical Report
- ☐ 10270 Alcoa Utilitube
- ☐ 10460 Process Industries Applications of Alcoa Aluminum
- ☐ 11453 Solving Refinery Corrosion Problems with Aluminum
- ☐ 20849 Resistance of Aluminum Alloys to Weathering and Resistance of Aluminum Alloys to Chemically Contaminated Atmospheres
- ☐ 20437 Aluminum Alloy Heat Exchangers in the Process Industries
- ☐ 19416 Brazing Alcoa Aluminum
- ☐ 19415 Welding Alcoa Aluminum
- ☐ 19051 Alcoa Aluminum Handbook

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ALCOA ALUMINUM
ALUMINUM COMPANY OF AMERICA

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## "Here at ST. REGIS we're kraft linerboard

—WHAT ABOUT MAINTENANCE?

Only OTIS can offer "minutes away" maintenance and engineering service wherever you are—through offices in 297 cities across the United States and Canada.

# men . . . not elevator maintenance men"

**DAVE ROBERTS**
*Plant Engineer*
**ST. REGIS PAPER COMPANY**
**Jacksonville, Florida**

"Here at ST. REGIS, ours is the specialist's approach to paper making. We know exactly what it takes to make quality Seminole Kraft Linerboard. It has been our business for years.

"It's the same with our OTIS Elevators. We have three of them. Two are used primarily as passenger elevators but they also handle light freight. The third, and most critical, is a 30,000 pound duty OTIS Hydraulic Freight Elevator. It is used to keep our finished output moving. Shutdowns would be costly.

"As specialists in maintaining paper making machines, we decided from the start that the OTIS specialist's approach to elevator maintenance was the best way to keep our elevators running. We have been well satisfied with our choice since 1953."

What is the OTIS specialist's approach to elevator maintenance?

It is MEN . . . MATERIALS . . . METHODS.

MEN: Elevator maintenance is no one-man job. It is an organization task requiring experts in many lines. No individual, even if he devoted his entire time to the job, could do it properly. It calls for men with an unusual combination of skills plus long training in studying parts, assemblies, functions, replacement procedures, testing and adjusting.

How much of the complete elevator installation does OTIS manufacture? Everything! Over 28,000 original and always available replacement parts. From the smallest switches in the machine room to the finished cars and entrances—to make certain that every OTIS installation performs as a completely integrated unit.

**freight elevator maintenance**

**THAT KEEPS ELEVATORS RUNNING LIKE NEW**

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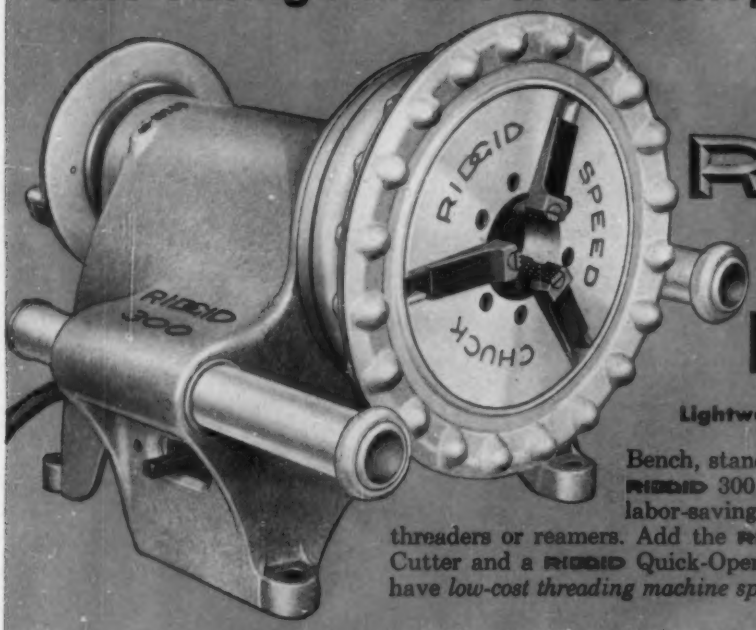
# Time-Saving Power For Your Shop or on the Job...



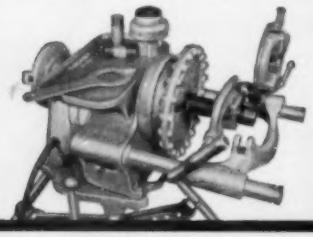

## New RIDGID 300 Power Drive

**Lightweight • Versatile • Low in Price**

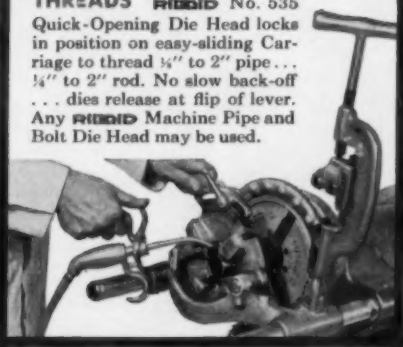
Bench, stand or truck mounted, this compact RIDGID 300 Power Drive gives you time and labor-saving power for your hand cutters, threaders or reamers. Add the RIDGID No. 310 Carriage, No. 360 Cutter and a RIDGID Quick-Opening Machine Die Head, and you have *low-cost threading machine speed and ease!*

## Here's What it Does!

**CUTS** RIDGID No. 360 Cutter, shown here, cuts ⅛" to 2" pipe and conduit—up to ½" rod. Extra-wide rolls keep cutter straight for perfect high-speed tracking. Cutter stays back out-of-way when not in use.

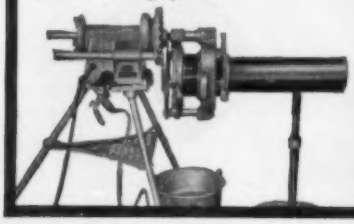


**THREADS** RIDGID No. 535 Quick-Opening Die Head locks in position on easy-sliding Carriage to thread ¼" to 2" pipe... ¼" to 2" rod. No slow back-off . . . dies release at flip of lever. Any RIDGID Machine Pipe and Bolt Die Head may be used.



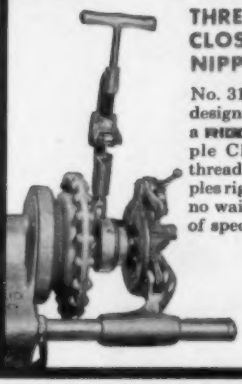
**REAMS** 300 Power Drive does all the work. Heat treated cutting edges of RIDGID "LonGrip" Reamer won't dig in . . . produce smooth pipe or conduit walls in seconds.

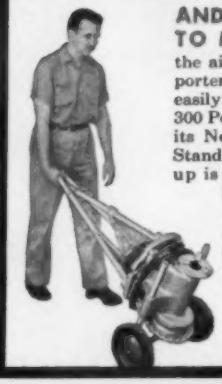
**DRIVES GEARED THREADERS** Compact, RIDGID No. 300 Power Drive has plenty of power for up to 12" geared tools. New RIDGID Close-Coupled drive shown here, for Nos. 141 and 161 Jam-Proof Threaders eliminates Universal Drive Shaft . . . saves working space.



**THREADS CLOSE NIPPLES**

No. 310 Carriage is so designed that by using a RIDGID No. 19 Nipple Chuck you can thread even close nipples right on the job... no waiting for nipples of special lengths.





**AND IS EASY TO MOVE** With the aid of the Transporter, one man can easily move a RIDGID 300 Power Drive with its No. 1206 Folding Stand attached. Set-up is fast and easy. Stand's integral tool tray locks legs in position, forming rigid work base.

**Save Time and Increase Your Profits on Every Job. See and Try This Biggest "Threading Machine" Bargain at your Supply House!**

RIDGID

The Ridge Tool Company, Elyria, Ohio, U.S.A.

For more facts circle 513 on Reply Card

# BULLETINS just released and of immediate plant interest

Postage-free Reader Service Cards make it easy to order bulletins. Cards are provided on pages 255 and 256.

## LIGHTING, COMMUNICATION

**Incandescent Lighting** — Illustrated and described in 32-pp Bulletin G is incandescent lighting equipment for general and industrial use. Reflector holders, lampholders, lamp extensions and reducers are illustrated and detailed specifications, suggestions for usage, and installation methods included. Benjamin Div., Thomas Industries, Inc.
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**Better Textile Lighting**—Importance of improved lighting in textile mills is stressed in "Higher Profits Through Better Textile Lighting," 12 pp. Discusses good lighting in terms of increased production, reduced costs, fewer accidents, fewer rejects, less maintenance. Analyzes economics of relighting and includes case histories of relighting experiences. General Electric Co.
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**Audible Signal Equipment**—Audible signal devices and the types most suitable for specific noise level areas are featured in 16-pp Bulletin K. Diagrams, specifications, mounting methods, decibel output charts and construction details given. Benjamin Div., Thomas Industries, Inc.
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## MECHANICAL POWER TRANSMISSION

**Adjustable Speed Drive**—Features and advantages of Polydyne mechanical adjustable speed drives are covered in 16-pp Bulletin GEA-6806. Discusses principles of operation, configurations and features, and includes mounting positions, rating tables, and description of accessories. General Electric Co.
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**Variable Speed Drive**—Eight-pp Bulletin GEA-7019 describes adaptability of the Thymotrol drive to machine feed and spindle applications, reeling equipment, conveyor systems, processing equipment, and other applications where precise speed control is essential. Ratings and specifications, and dimensions are given. General Electric Co.
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**Electromagnetic Drives**—Illustrated and described in 12-pp Bulletin B-7875 is a line of electromagnetic drives for conveyors, fans and pumps, winders, metal slitting and forming machines, paper mill machinery, and anywhere need for speed control exists. Operation of drives discussed. Westinghouse Electric Corp.
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**Shaft-Mounted Reducers**—Twelve-pp Form F-2003 provides technical information on shaft-mounted geared speed reducers as well as selection instructions on the Shaftmount Syncrogear. Tables show service classifications to be applied in determining types of speed reducers for various industrial applications and conditions of usage. Also provided are high and low gear-ratios for each horsepower and frame size, with preferred ratios for specific motor rpms. U. S. Electrical Motors Inc.
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**Stepless Variable Speed**—Illustrated and described in 16-pp Catalog ZM-400C is a line of stepless variable speed drives for fractional horsepower applications. Operating features and installation suggestions are accompanied by numerous diagrams and tips on power transmission. The Zero-Max Co.
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**Speed Reducers**—Parallel shaft speed reducers which permit shafts to be arranged to suit specific drive requirements are featured in 36-pp Book 2719. Rating tables contain thermal and mechanical horsepower ratings for each input and output speed, and overhung loads, extended shafts and outboard bearings, dimensions and actual ratios are included. Link-Belt Co.
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**Torque Manual**—This 32-pp catalog is a recent revision of company's popular torque manual. Includes application illustrations, bolt charts, discussions on assembly characteristics, instructions for torque wrench testing, pictures of modified and special torque wrenches, formulas and illustrated explanations for using adapters, attachments and extensions. P. A. Sturtevant Co.
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**Flexible Shaft Handbook**—A simplified approach to selection of flexible shafting through standard, pre-engineered, or custom-designed flexible shafts is offered in this 90-pp handbook. Describes advantages of flexible shafts, their function and applications, and includes tables, charts and drawings to aid in selection. S. S. White Industrial Div.
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## FANS, BLOWERS

**Draft Fans**—Information on high volume radial tip mechanical draft fans for induced draft service in large industrial plants, central power stations, paper mills, sintering plants, etc. is presented in 6-pp Bulletin RT-100. Mechanical efficiency curve, dimensional data and diagrams included. Chicago Blower Corp.
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**Positive Displacement Blowers**—Horizontal and vertical blowers and gas pumps designed to automatically provide a metered quantity of oil-free air at constant volume, even against variable pressure, are described in 12-pp Bulletin S59-H. Performance and dimensional data is given by means of charts and drawings. Sutorbilt Corp.
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## VALVES, FITTINGS

**Industrial Valves**—Detailed information on company's valves is presented in 20-pp Catalog 800-A. Also contains competitive cross reference charts and weight tables for comparative purposes, and data covering a variety of pressure controls, temperature controls, solenoid valves and strainers. Detroit Controls Div., American-Standard.
▲ For a copy, circle 114 on Post Card

**Hot Water Balancing Valve**—Bulletin 204 describes a dual-purpose hot water balancing valve designed to do the work of two valves on return line of water coil. Explains built-in "memory" device and includes dimensional data and specifications. American Air Filter Co., Inc.
▲ For a copy, circle 115 on Post Card

**Pressure Reducing Valve**—Described in this catalog sheet is a pressure reducing and relief valve for use in water, oil, air or gas service to initial pressure of 4000 psi. Includes drawings, capacities. Atlas Valve Co.
▲ For a copy, circle 116 on Post Card

**Type O Joint**—Bulletin E-460-60 describes a Typo O joint for vitrified clay pipe. Includes installation procedures, dimensional data and specifications. The Evans Pipe Co.
▲ For a copy, circle 117 on Post Card

**Cyclone Strainer**—Eight-pp Bulletin S-1 describes design features of a cyclone strainer featuring completely automatic cleaning and/or backwashing. Includes graphs for specifying and selection, and diagrams of typical arrangements. Henry Pratt Co.
▲ For a copy, circle 118 on Post Card

**Fittings and Hose**—Detailed information on fittings and hose for high pressure service is presented in 12-pp Catalog 4430. Advantages and characteristics are described and selection tables included. Parker Fittings and Hose Div., Parker-Hannifin Corp.
▲ For a copy, circle 119 on Post Card

## INSULATION

**Improved Pipe Wrap**—Described in this 10-pp brochure are advantages of using laminated butyl rubber and plastic tape in combination with a butyl base primer as a corrosion resistant pipe wrap for protecting pipe lines, process lines etc. Gives full specifications on Plicoflex tape and shows some of its uses. Plicoflex, Inc.
▲ For a copy, circle 120 on Post Card

**Calcium Silicate Insulation** — Pipe and block insulation of calcium silicate for use in power, chemical, petroleum, petrochemical and manufacturing industries is featured in Form 6472. Lists heat transmission data, physical and thermal characteristics. Philip Carey Mfg. Co.
▲ For a copy, circle 121 on Post Card

# BULLETINS

(Begins on page 21)

## HEATING, COOLING

**Electric Heaters, Devices** — Product and application data for Calrod tubular heaters, finned tubular, cartridge, strip, insertion, and vane heaters, forced and natural convection air heaters, and oven heaters are presented in 49-pp Bulletin GEC-1005K. Includes sections on heater control and wiring diagrams, application and heater selection in both long and short forms, photos and dimensional drawings. General Electric Co.
▲ For a copy, circle 123 on Post Card

**Heaters for Metals Industry**—Plant heating problems in the metalworking industry, and the solutions offered by overhead recirculating heaters, fresh air supply heaters, and door heaters are discussed in Bulletin MI-60. Covers problems of warm air distribution in areas full of machinery or stocks of raw materials, replacement of air exhausted by fume removal systems. L. J. Wing Mfg. Co.
▲ For a copy, circle 124 on Post Card

**Infrared Heating**—Advantages of infrared comfort heating are illustrated and described in 8-pp Bulletin CH-100. Typical applications are described and engineering information included. Fostoria Corp.
▲ For a copy, circle 125 on Post Card

**Finned Tube Radiation**—Presented in 16-pp Bulletin 460 is finned tube radiation for steam and hot water. Gives features, ratings and dimensional data for radiation with standard enclosures and with deluxe enclosures, as well as information on trim pieces and accessories and possible arrangements. Also shows flattop covers for use where enclosures are not desired. Modine Mfg. Co.
▲ For a copy, circle 126 on Post Card

**Multi-Tube Exchangers** — Multi-tube heat exchangers for high-capacity applications are featured in 8-pp Bulletin 111. Cutaway drawings show details of shell to tube closure and return bend housing and tables list specifications. Brown Fintube Co.
▲ For a copy, circle 127 on Post Card

**Heat Transfer Equipment**—Featured in 32-pp Catalog 160 is a line of heat transfer equipment, including radiators, heat exchangers, supercharger air coolers, industrial and oil field equipment and heating and air conditioning products. Includes complete product resume including installation photos. Young Radiator Co.
▲ For a copy, circle 128 on Post Card

## WATER, WASTE TREATING

**Treatment for Cooling Waters**—How to treat water to assure trouble-free operation of cooling water systems is outlined in 6-pp Reprint 88. Covers major factors that cause problems in industrial cooling systems and includes a flow diagram that points up corrosive factors in cooling water systems. Nalco Chemical Co.
▲ For a copy, circle 129 on Post Card

**Small-Flow Sewage Treatment**—Eight-pp Bulletin 7315 describes a unit providing complete sewage treatment in a single tank using mechanized sanitary engineering methods, for small to medium-sized industrial and other installations. Dorr-Oliver Inc.
▲ For a copy, circle 130 on Post Card

**Water Demineralizers** — Mixed-bed, two-bed and four-bed demineralizers for industrial water purification are featured in 36-pp Catalog 160. Profusely illustrated with charts, specification drawings and photos. Barnstead Still & Sterilizer Co.
▲ For a copy, circle 131 on Post Card

**Briquet Feeding System**—Details on egg-shaped briquets designed to dissolve at a uniform rate releasing continuous feed of chemical into treatment systems are presented in Technical Bulletin CS-110. Operation is diagrammed, advantages detailed. Ionac Chemical Co., Div. Pfaudler Permutit Inc.
▲ For a copy, circle 132 on Post Card

**Slime Control**—This water conditioning data sheet discusses slime control with chlorine and non-oxidizing biocides. Explains how the judicious use of chlorine and the supplemental use of other biocides extend coating tower life. Betz Laboratories, Inc.
▲ For a copy, circle 133 on Post Card

### What's the Corrosion Risk? These Aids Can Tell You

**Corrosion Data Charts**—Corrosive effects of almost 400 different materials on 16 types of metals are shown in corrosion data charts contained in Technical Service Bulletin 101. Charts indicate corrosion resistance of metals to various concentrations of chemical salts and acids, as well as common materials such as water, glue, fruit juices, salt, turpentine, others. Nooter Corp.
▲ For a copy, circle 134 on Card

**Corrosion Computer**—This corrosion computer works like a slide rule and tells how each of eight types of metal withstands corrosive effects of 141 chemical agents. Metals are common in mechanical work—brass and naval bronze, silicon bronze, monel metal, stainless 410, 416 and 430, stainless 302, 303, 304 and 305; stainless 316, copper and aluminum. The H. M. Harper Co.
▲ For a copy, circle 135 on Card

## ELECTRICAL

**Substation Transformers** — Detailed information on liquid-filled substation transformers, single- and three-phase, 501 to 10,000 kva and up to 69 kv, is presented in 16-pp Bulletin 5800-1A. Dimensions for single and three-phase oil immersed transformers and specifications included. I-T-E Circuit Breaker Co.
▲ For a copy, circle 136 on Post Card

**Dry-Type Transformers**—Selection and application information on dry-type transformers is presented in 24-pp Bulletin GEA-6907A. Prices, dimensions and specifications for single- and three-phase general-purpose transformers, autotransformers, buck-boost transformers as well as for distribution and voltage-stabilizing transformers are included. General Electric Co.
▲ For a copy, circle 137 on Post Card

**Manual Motor Starters** — Bulletin GEA-6358C, 12 pp, describes a manual motor starter for fhp motors and another for integral horsepower motors to 7½ hp. Illustrations include photos showing construction features, dimensional diagrams and photos showing two basic forms for each type of starter: toggle and key operated for the fph unit and toggle and push button for the other starter. General Electric Co.
▲ For a copy, circle 138 on Post Card

**Magnetic Starters**—Brochure 14-B2 describes magnetic starters featuring unitized construction with all components front removable. Application and features of design are described. Furnas Electric. Co.
▲ For a copy, circle 139 on Post Card

**Reduced-Voltage Starters** — Eight-pp Bulletin GEA-6860A describes reduced voltage starters for starting squirrel-cage motors in all types of applications. Detailed selection data included. General Electric Co.
▲ For a copy, circle 140 on Post Card

**Motor Insulation Systems**—Technical details on an epoxy insulation system for motors are presented in Bulletin PB 6000-12. Random wound and form wound motors are illustrated. Elliott Co.
▲ For a copy, circle 141 on Post Card

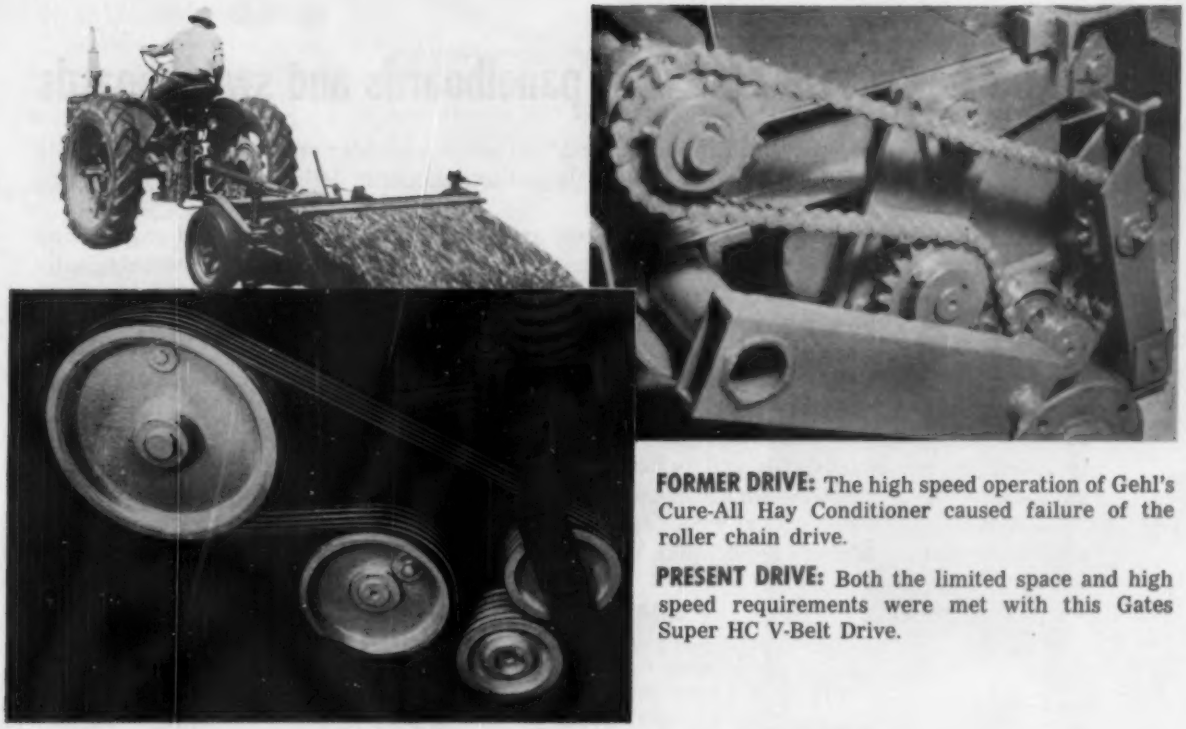
**Cellular Floor Raceway** — Eight-pp Catalog 60 contains product illustrations and detailed information for specifying and installing cellular floor feeder raceway. Contains suggested architectural specifications for the cellular floor feeder raceway, unit spacing and lengths, assembly fittings, junction units, and cross section drawings of cellular steel floors. Wheatland Electric Products Co.
▲ For a copy, circle 142 on Post Card

## MATERIALS HANDLING

**Basic Pallet Handling**—This pocket-size 16-pp booklet covers the ABC's of pallet handling, illustrates different types of pallets and explains their uses. Advantages of wood and metal pallets are listed and pallet specifications given. The Raymond Corp.
▲ For a copy, circle 144 on Post Card

**Bulk Material Handling** — Features and advantages of the Tote system of bulk material handling are detailed in 32-pp Catalog 8. Describes it as an inplant and interplant system, as an automated system, as distinct storage units, and as discharge hoppers and shipping containers, and gives detailed explanations of filling, discharging, storing, shipping bins. Tote System, Inc.
▲ For a copy, circle 145 on Post Card

(More Bulletins on page 257)



**FORMER DRIVE:** The high speed operation of Gehl's Cure-All Hay Conditioner caused failure of the roller chain drive.

**PRESENT DRIVE:** Both the limited space and high speed requirements were met with this Gates Super HC V-Belt Drive.

## Gehl Brothers Manufacturing Company Finds

# Super HC V-Belt Drive handles speeds chain drive couldn't take!

Roller chain drives on Gehl's Cure-All Hay Conditioners **"would not stand up under the speed of operation." Yet conventional V-belts that would fit into the space available could not handle the working load for this outstanding line of forage harvesting equipment.**

The design problem remained a tough one until the introduction of the Gates Super HC High Capacity V-Belt early last year. Then the Gates Field Engineer, working closely with Gehl Engineers designed the new drive shown above.

"The Super HC V-Belt Drive has eliminated need for shear pins and clutches, has increased efficiency, and lowered maintenance costs," is the pleased report from Gehl personnel.

### Take advantage of Super HC on your equipment

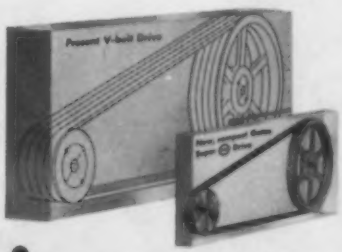
Whenever you have a drive change on a new model or are replacing belts or sheaves, let your Gates Representative show you how Super HC Drives can reduce sheave diameters 30% to 50%, drive space up to 50%, drive weight and cost as much as 20%.

A handbook, "The Modern Way to Design Multiple V-Belt Drives," is yours for the asking. Simply contact your Gates Representative listed in the Yellow Pages.

TPA 505

**The Gates Rubber Company,** Denver, Colorado
Gates Rubber of Canada Ltd., Brantford, Ontario

Gates *World's Largest Maker of V-Belts*



# Gates Super HC V-Belt Drives

same hp capacity in smaller "package"

For more facts circle 514 on Reply Card

# FAST SERVICE for panelboards and switchboards

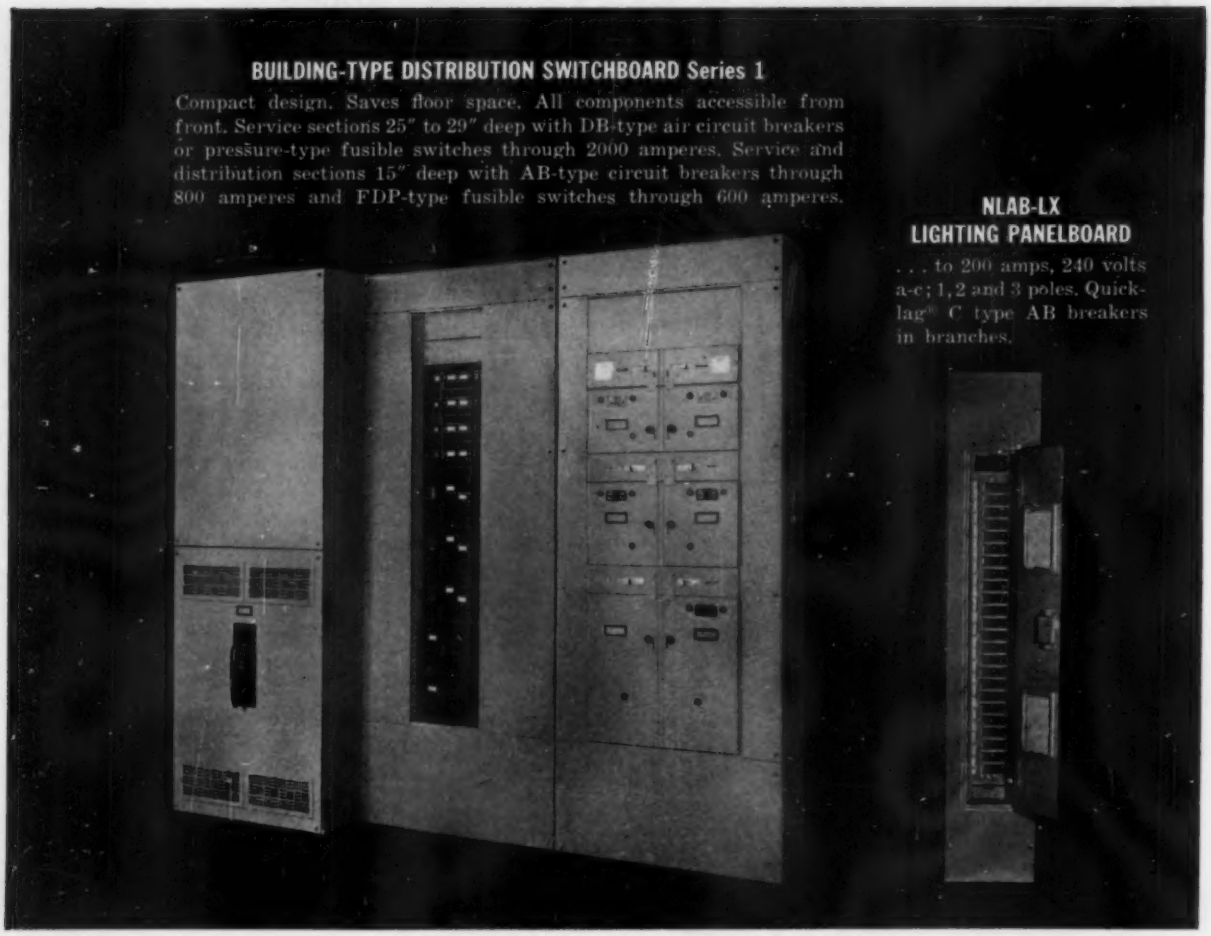
For new construction or modernization of electrical service in older structures, Westinghouse can meet your needs from a line of panelboards and switchboards designed for every type and size of low-voltage distribution system.

Standardized components lower installed cost and eliminate special design and engineering time—yet each job is custom assembled to meet your code requirements. Eleven strategically located Westinghouse assembly plants, plus over 200 electrical wholesalers across the country, provide fast service on any job, anywhere in the U.S. Uniform high quality, and therefore dependable performance, is assured.

All Westinghouse circuit breaker panelboards and switchboards are equipped with famed Westinghouse AB De-ion® breakers which provide fast, automatic trip on short circuits—and a visual "tripped" indication—but with full time delay on harmless overloads. Fusible-type distribution panelboards and switchboards are available with FDP Life-Line® switches, quick-make, quick-break De-ion arc quenchers and visible blades.

Your Westinghouse electrical wholesaler offers a complete line of Westinghouse panelboards and switchboards for every application. You can be sure . . . if it's Westinghouse. J-93555

Westinghouse



**BUILDING-TYPE DISTRIBUTION SWITCHBOARD Series 1**

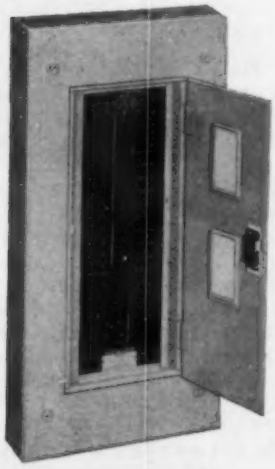
Compact design. Saves floor space. All components accessible from front. Service sections 25" to 29" deep with DB-type air circuit breakers or pressure-type fusible switches through 2000 amperes. Service and distribution sections 15" deep with AB-type circuit breakers through 800 amperes and FDP-type fusible switches through 600 amperes.

**NLAB-LX LIGHTING PANELBOARD**

. . . to 200 amps, 240 volts a-c; 1, 2 and 3 poles. Quick-lag® C type AB breakers in branches.

## NPLAB LIGHTING PANELBOARD

. . . to 225 amps, 240 volts a-c; 1, 2 and 3 poles. Quicklag P (plug-in) AB breakers in branches, E and J frame main breakers. Handle extensions permit simultaneous manual operation of 2 single-pole breakers. Common trip handle on 2- and 3-pole units.

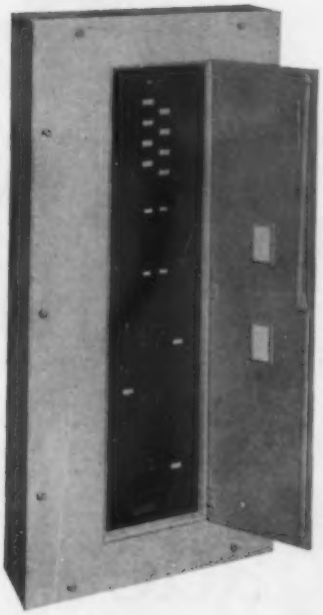


## CDP CONVERTIBLE-TYPE DISTRIBUTION PANELBOARDS

. . . main breakers to 800 amps, main lugs to 1200 amps, 600 volts a-c, 250 volts d-c; 1, 2 and 3 poles. E, EH, F, J, JK, K, JKL, KL and LM frame AB breakers in branches.

## NA1B LIGHTING PANELBOARD

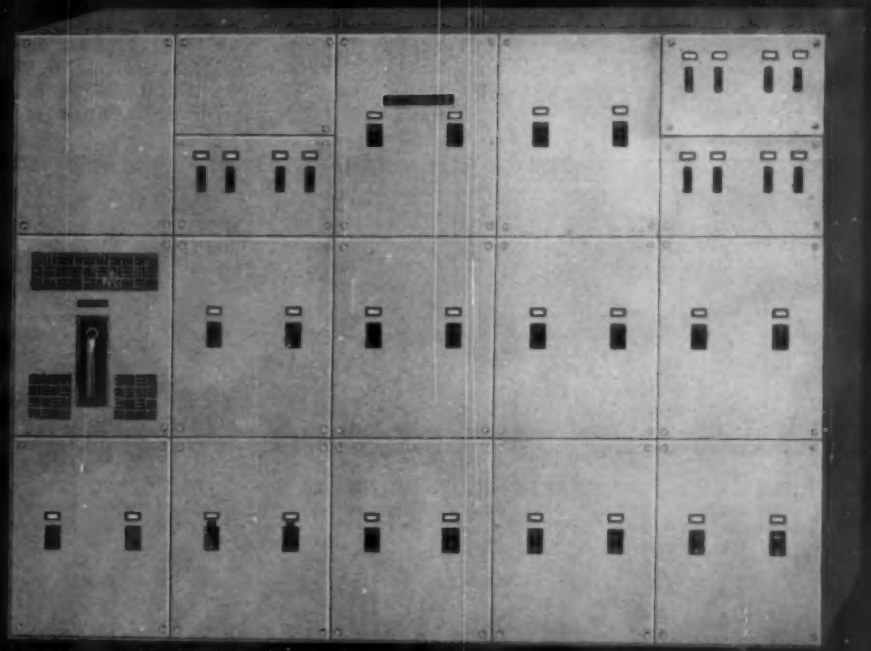
. . . to 225 amps, 240 volts a-c or 125/250 volts d-c; 1, 2 and 3 poles. E frame AB breakers in branches, E and J frame main breakers.



## BUILDING-TYPE DISTRIBUTION SWITCHBOARD Series 2

Standardized switchboard design with main horizontal bussing from 600 through 4000 amperes. Standard depths 36" through 54". DB-type air circuit breakers or pressure-type fusible switches through 4000 amperes. AB-type circuit breakers through 800 amperes, Tri-pac* current limiting breakers through 600 amperes and FDP-type fusible switches through 600 amperes.

*Trade-Mark



# Oven and dryer building made easier!

**J-M MARINITE®** *is both oven wall and insulation in one workable material!*

To build the most efficient ovens and dryers you've ever operated, all you need is one material: Marinite. J-M Marinite is a rigid insulating material that also serves as your oven and dryer wall. You build and insulate (up to 900F) in *one* operation with *one* material. Marinite is an unequaled combination of efficient insulation and structural strength. It costs you no more in place than other materials, and saves you time and effort.

**HERE'S WHY:**

**MARINITE IS WORKABLE.** It cuts easily. Your own shop can prefabricate panels from large 4′ x 8′ or 4′ x 10′ sheets with standard saws and drills . . . and assemble them quickly. Rigid Marinite requires a minimum of structural support.

**MARINITE CUTS MAINTENANCE.** Your ovens require little or no maintenance because Marinite lasts indefinitely. It will never rust, rot or corrode. It is made of asbestos fiber, diatomaceous silica and an inorganic binder. It will not disintegrate even in the most humid, moist conditions. Paint Marinite if you wish—but painting isn't necessary.

**MARINITE INCREASES EFFICIENCY** Marinite's low conductivity saves fuel and cuts heat loss so effectively that you can gain comfortable extra working space nearer your ovens. There's no through-metal except for a few necessary bolts, and staggered-joint construction keeps your insulating effectiveness high. No "hot-spots" caused by soft insulations that settle and sag—solid Marinite *stays put!*

**FIREPROOF MARINITE** has Fire Underwriters' approval. For constructing ovens, dryers and other insulated housings—you just can't find a better material than dual-purpose Marinite. Complete information in our Brochure IN-153A. Write to Johns-Manville, Box 14, New York 16, N. Y. In Canada: Port Credit, Ontario.

BENCH TYPE CIRCULAR SAW *makes straight cuts. Use heavy-duty portable power saw for small jobs.*

PORTABLE POWER DRILL *and templet insure easy drilling and accurately placed holes.*

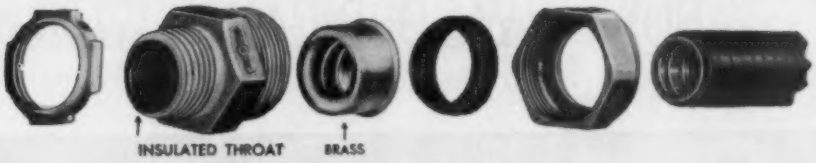
CIRCULAR CUT-OUTS AND DISCS *are fly-cut with a radial power drill. Make other cut-outs with portable power saws.*

JOHNS-MANVILLE

JOHNS-MANVILLE PRODUCTS

AN INSULATION FOR EVERY COMMERCIAL AND INDUSTRIAL USE.

**For more facts circle 516 on Reply Card**




Malleable Iron Liquid-Tite Connectors

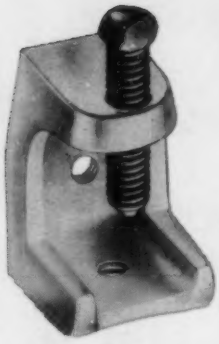
# QUALITY MALLEABLE IRON FITTINGS ARE AVAILABLE!

## GEDNEY'S

*Complete Line is Precision-Made of Unbreakable Malleable Iron . . .*

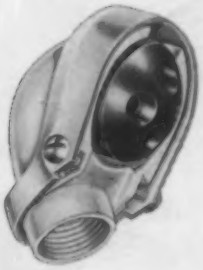
- *Unmatched for Toughness*
- *Impervious to Corrosion*

**GEDNEY FITTINGS FIT**



M.I. Beam Clamps

M.I. 90° Corner Adapters and Corner Elbows



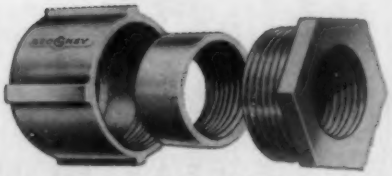
M.I. Entrance Caps

M.I. Offset Connectors and Offset Nipples

M.I. Insulated Bushings

M.I. Conduit Bodies

M.I. Armored Cable & Non Metallic Connectors

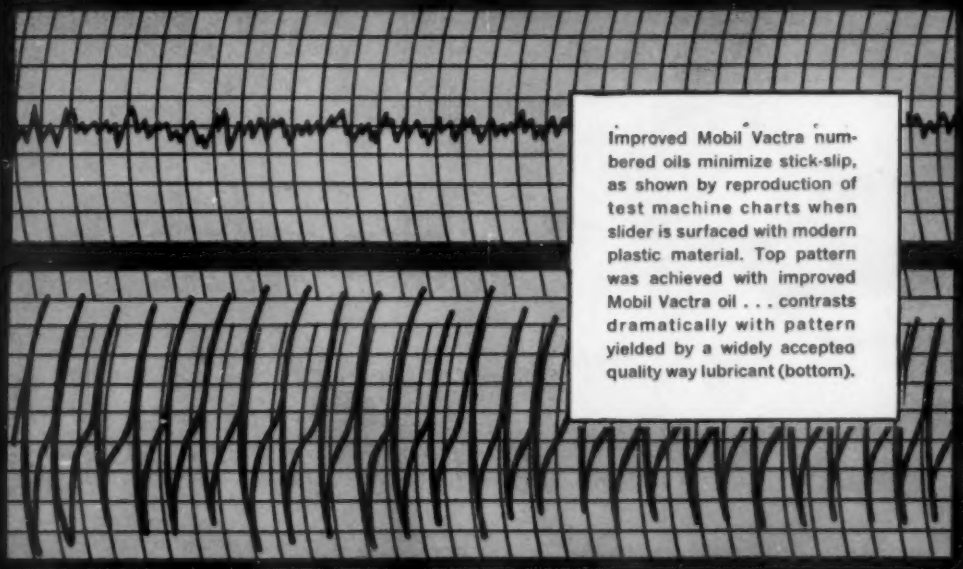


M.I. 3 Piece Conduit Couplings

For more facts circle 517 on Reply Card

# NOW! WAY LUBRICANTS WITH ALL SIX

Stick-slip tester developed by Mobil's research laboratories closely simulates operating conditions of today's machine tools . . . records stick-slip electronically as weighted slider is pulled across lubricated cast iron bed.



Improved Mobil® Vactra® numbered oils minimize stick-slip, as shown by reproduction of test machine charts when slider is surfaced with modern plastic material. Top pattern was achieved with improved Mobil Vactra oil . . . contrasts dramatically with pattern yielded by a widely accepted quality way lubricant (bottom).

# QUALITIES REQUIRED BY TODAY'S MACHINE TOOLS!

# IMPROVED MOBIL VACTRA Nos. 1·2·3·4

## Excellent for all way systems, all way surfaces, all operating conditions!

To meet the diverse requirements of today's complex machine tools, way lubricants must function effectively under a variety of operating conditions . . . must possess not one or two, but *six* important capabilities.

Now you can get all six—with Improved Mobil Vactra® oils Nos. 1-4, inclusive!

These improved Mobil Vactra oils provide these advantages: • Minimum stick-slip on all types of ways—steel, cast iron or plastic. • Control of table "float" through correct viscosity—without risk of film failure and wear. • Protection against way scoring through controlled EP qualities. • Prevention of lubricant filter clogging. • Protection against rust and corrosion. • Stability under all normal operating conditions.

Improved Mobil Vactra oils Nos. 1-4 offer these benefits:

- **Increased Machine Availability,** because less downtime is required for adjustments...especially significant with today's high overhead and burden rates.
- **Fewer Rejects,** through greater precision and better finishes . . . vitally important with today's closer tolerances and the high cost of finished pieces.
- **Minimum Maintenance Costs,** through effective protection of critical way surfaces.

Available in four viscosities, Improved Mobil Vactra numbered oils permit the selection of a grade exactly suited to any critical operating condition. For complete details, call your Mobil Representative or use the coupon below.

Mobil

MOBIL OIL COMPANY
150 East 42nd Street
New York 17, N. Y.

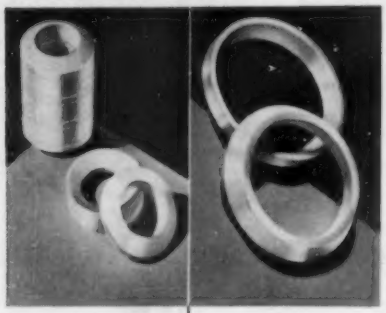
Mobil Oil Company
Room 2057-G
150 East 42nd Street
New York 17, N. Y.

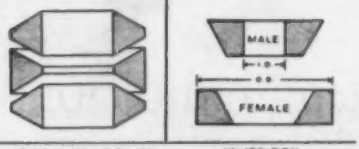
*Gentlemen:* I am interested in using Mobil Vactra Nos. 1-4 to help alleviate way lubrication problems at my plant.

*Name*_____
*Position*_____
*Company*_____
*Address*_____
*City*_____ *State*_____

**For more facts circle 518 on Reply Card**

# *NEW* CHEMPRO
## LOW GLAND PRESSURE
## TFE TEFLON† PACKING SETS






"CUP AND CONE" "WEDGE"

**USED FOR VALVES, HEAT EXCHANGERS AND OTHER STATIC AND SEMI-STATIC APPLICATIONS**

Chempro Style 300 "Cup & Cone" and Style 305 "Wedge" packing ring sets are two new resilient, low gland pressure packings designed for tight, sure sealing with a minimum gland pressure. Nominal gland pressure causes the rings to slide against each other, exerting pressure both against the stem or rod and the bore.

These packings have all the advantages of Teflon, being completely unaffected by the strongest acids, solvents and alkalies.

**COMBINATION SETS AVAILABLE FOR ROTATING SERVICE**

Resilient Chempro "Cup & Cone" or "Wedge" rings can be combined with tough, pressure-resisting Chempro Style 101 packing rings to form a rugged combination set ideal for use on a wide range of rotating or reciprocating services.

*Write for revised Chempro Bulletin CP-552, giving complete ordering information.*

† duPont trademark

CHEMICAL & POWER PRODUCTS, Inc.

7 Broadway, New York 4, N. Y.

**For more facts circle 519 on Reply Card**


# BACKTALK AND FORETHOUGHTS

*Edited by Marjorie E. Weissman*

## Indispensable Reprints

PLANT ENGINEERING:

"We were very pleased to discover the series of articles on 'Construction Cost Estimating' in recent issues of PLANT ENGINEERING and have since found this information very valuable. Two copies of this series of articles in booklet form are currently being used with great profit by all members of our Design and Construction departments, and in fact, have become a necessary part of our operation.

"The widespread use of this booklet has made it imperative that we request three additional copies from you. A check in the amount of $4.50 is enclosed to cover the cost of these reprints." *E. J. Volke, Jr., Facilities Design Department, International Business Machines Corp., New York, N.Y.*

PLANT ENGINEERING:

"Kindly advise when reprint copies will be available in booklet form of the articles included in your 'Time Saver Series' for construction cost estimating, which have been included in recent copies of PLANT ENGINEERING. Also advise how these can be ordered." *J. C. Brightfelt, Superintendent, Maintenance and Construction, Erie Relations & Utilities Operation, General Electric Company, Erie, Pa.*

■ This series of 12 articles is now available in booklet form for $1.50. Order from this office.—*Editors.*

## More on Maintenance Facilities

PLANT ENGINEERING:

"Will you please send me tear sheets of articles available on the layout of maintenance facilities and offices. I really enjoy and gain lots of know-how from your publication." *Edwin W. Chaffee, P.E., Administrative Engineer, Rhode Island Hospital, Providence, R. I.*

■ Our supply of tear sheets on this subject is running low but we have sent several to Mr. Chaffee with our compliments.—*Editors.*

## The Magazine that Helps

PLANT ENGINEERING:

"Receipt of tear sheets on lubrication scheduling and maintenance work control procedures are acknowledged and are greatly appreciated. PLANT ENGINEERING is a magazine that helps plant engineers with their everyday problems and, as such, will occasionally aid the industrial engineer in assisting the plant engineer in the solution of many problems by utilizing industrial engineering tools such as time study, work sampling, etc.

"USNOP, Macon, has been subscribing to this fine magazine and will continue to do so for its value—it has assisted us on several occasions." *Robert G. Provost, Supervisory Industrial Engineer, U.S. Naval Ordnance Plant, Macon, Ga.*

## Where To Find It

PLANT ENGINEERING:

"On page 113 of your August edition under 'How To Dry Air in Pneumatic Systems,' you show a graph plotting pounds of water versus temperature and pressure. I would appreciate it very much if you would tell me where you got this graph, or if possible, send me an 8½- by 11-in. copy." *T. E. Smith, Jr., Burford, Hall and Smith, Atlanta, Ga.*

■ Address supplied.—*Editors.*

## Lighting Calculator

PLANT ENGINEERING:

"In the article on industrial lighting by Willard Allphin, we have noted an offer for a free lighting calculator. The series of articles on this subject should prove very valuable to us and we would appreciate receiving one of these calculators.

"We wish to express our thanks and appreciation for the excellent articles which appear regularly in your magazine PLANT ENGINEERING." *P. Danciu, Works Engineer, Otis Elevator Company, Ltd., Hamilton, Ont.*

PLANT ENGINEERING:

"Article by Mr. Allphin on lighting in your September, 1960 issue of PLANT ENGINEERING noted with interest.

"Like to see 'basics' brought out from time to time on problems such as lighting, as we are sometimes inclined to take too much for granted and jump to conclusions. Keep more of these articles coming.

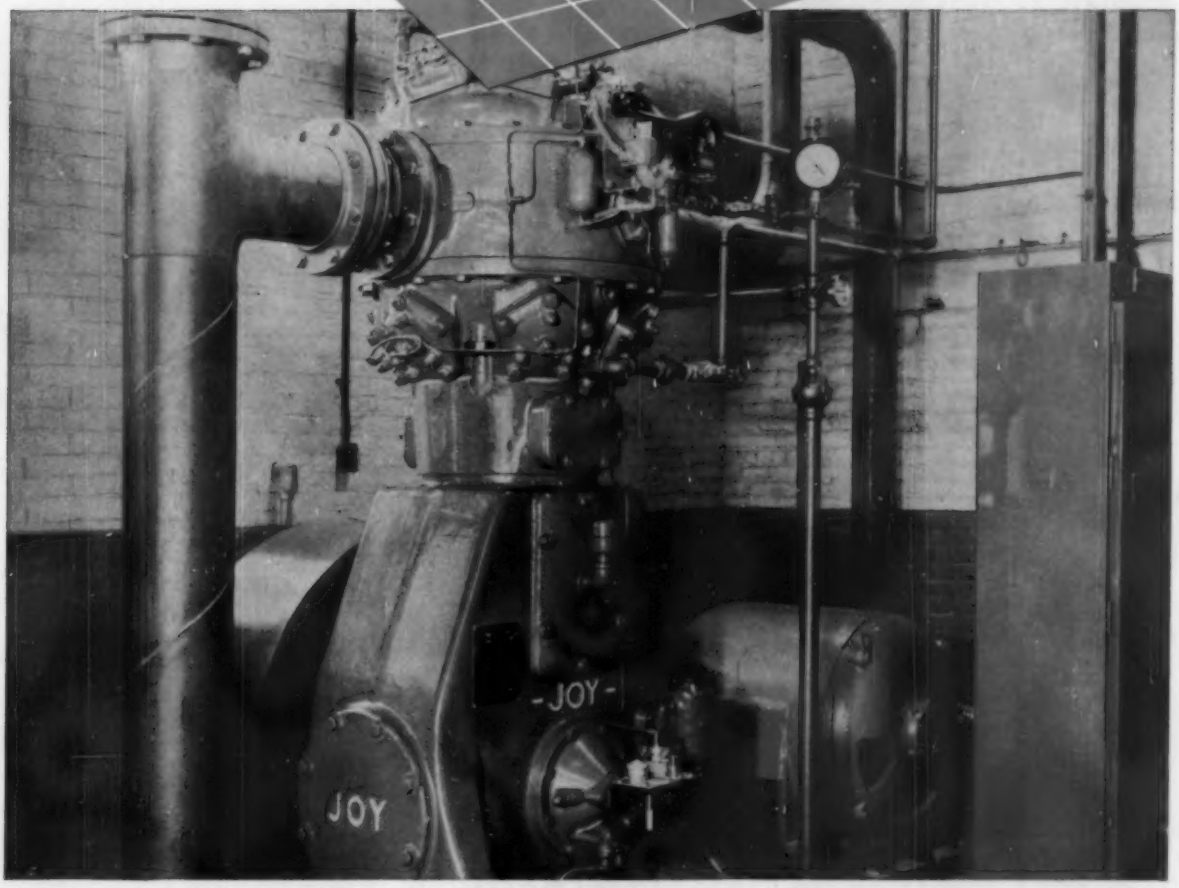
"Would appreciate the lighting calculator offered on page 119." *T. C. Ferguson, Asst. Supr. of Methods, The Mosaic Tile Co., Zanesville, Ohio.*

PLANT ENGINEERING:

"Will you please send me a complimentary Sylvania lighting calculator?

"May I take this opportunity to

# A 150 Horsepower Compressor in just 35 Square Feet of Floor Space . . .

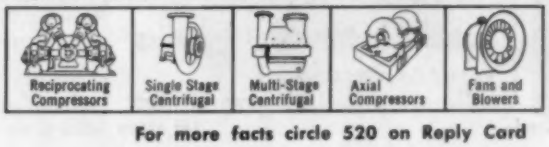



## the JOY WG-9 Vertical Compressor

You can make full use of the space *above* the floor when you specify a Joy WG-9 vertical compressor. Thousands of these heavy-duty units have been installed in existing spaces which were too small for other compressors of comparable capacity.

Joy WG-9's are the only machines in their field offering so many "big compressor" features—replaceable cylinder liners and crosshead guides, anti-friction main bearings that never require adjustment, full force-feed lubrication of all working parts. These heavy-duty features mean dependable performance year after year. Eighteen standard models are available in a range from 15 to 150 horsepower, plus special models for high and low pressures and oil-free operation. One of them is just right for your next plant expansion. Get complete details by writing for bulletin 2414-15.

**AIR MOVING EQUIPMENT FOR ALL INDUSTRY**




JOY

**Joy Manufacturing Company**
**Oliver Building, Pittsburgh 22, Pa.**

In Canada: Joy Manufacturing Company (Canada) Limited, Galt, Ontario

**For more facts circle 520 on Reply Card**

INTRODUCING...

ADVAN

CONTI

**14** new features for
**TOP PROTECTION OF PEOPLE, EQUIPMENT**
including...

**POLYESTER "SANDWICH"** isolates, insulates vertical bus – blocks spread of fault from starter to vertical or horizontal bus; guards personnel from accidental bus contact.

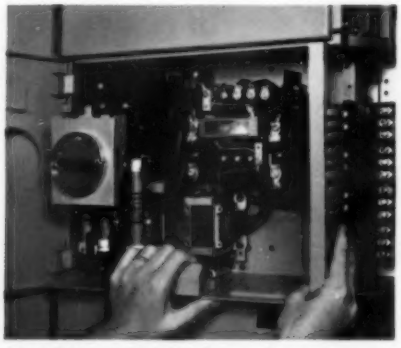
**WEDGE-LIKE UNIT STAB** pressure—engage verti contact; expand unde prevent "pop out" du

**12** new features for
**FAST AND EASY FIELD INSTALLATION**
including...

**ISOLATED WIRE TROUGH** provides roomy area to "lay in" wire and make control and load connections. Separate full-height door makes wiring installation and inspection easy.

**CONVENIENT TYPE B TER** in wiring trough—is ac out. Sliding coded cove cidental contact with t

**10** new features for
**SIMPLE INSPECTION AND MAINTENANCE**
including...

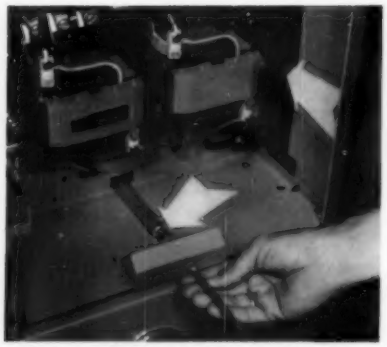


**DRAWOUT CONNECTIONS** permit starter unit removal or insertion without disturbing load or control wiring; allow inspection of individual starters without complete shutdown.

**UNIQUE SLIDING COVERS** isolation barrier . . . ope inspection and mainten horizontal bus connecti

# NCED-DESIGN
# TROL CENTER

STABS — under double-spring vertical bus, provide positive under short circuit stress to t" during fault.



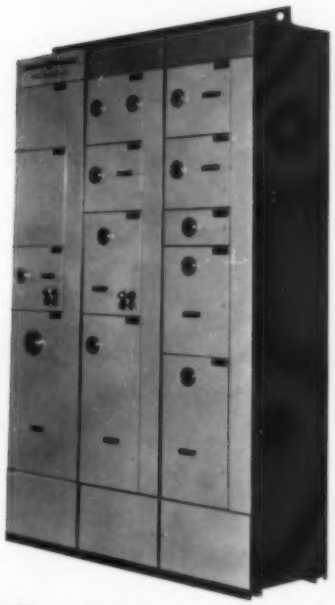
**POSITIVE UNIT GUIDANCE SYSTEM** — slot on starter unit and matching track on barrier—gives smooth travel of unit, positive alignment of stabs and drawout "B" block.

**B TERMINAL BLOCK**—fixed half -is accessible with unit in or d cover insulators prevent ac- with terminals.

**INCOMING LINE TERMINAL** compartment can be located at top or bottom, allows straight-line cable terminations — eliminates bending and looping of heavy cables.

**OVERS** close to form effective . . open easily to permit front intenance of the vertical and nnections.

**ROTARY HANDLE MECHANISM** — for circuit breaker or fused switch — is mounted on unit; gives positive interlock; clearly shows device position; locks "ON" or "OFF."



## CONTROL CENTER

### . . . all-new grouped control for independent or coordinated units

Now . . . from General Electric comes the all-new, *advanced-design* Control Center. Combined in this center are more than 40 new features that add up to outstanding performance in equipment protection, personnel safety, and ease of installation and maintenance.

This centralized control for a-c and d-c motors also provides interlocking and sequencing of motor operation and over-current protection of feeder and branch circuits—including lighting. The *advanced-design* Control Center—with short circuit interrupting capacity up to 100,000 amperes — will handle: (1) motor starters to NEMA Size 6; (2) feeder circuits to 800 amperes; and, (3) power concentrations to 1200 amperes.

The building-block, modular construction of the General Electric Control Center adapts quickly to a variety of layouts to fit available space . . . permits optimum arrangement of starter units within each section to meet any application. This flexibility of design makes allowance for future expansion or modification to meet changing requirements . . . without costly downtime or major added investment.

For complete information on *advanced-design* General Electric Control Center, contact your General Electric Sales Representative or Distributor. Or, write General Electric Co., Schenectady 5, N. Y. *Industry Control Dept., Salem, Va.; Distribution Assemblies Dept., Plainville, Conn.* 783-17

GENERAL ELECTRIC

a major advancement in
.....grouped motor control

# NEW GENERAL ELECTRIC CONTROL CENTER

## FULLER PNE
## PRODUCTION

Recent installation of speciall
pneumatic conveying systems t
helped Goodyear Tire and Ru
duction. These systems are the
from over 15 years experience
rubber pellets. These completel
virtually eliminate contaminat
duce the chance of loss due to

Automated handling of crude
Conveying Systems, in place
sheeting on a mill, is the key.
the pelletized rubber from the p
distance of 500 feet. Four mo
sink dump scales to inlet spout

FULLER COMPANY GENERAL AMERICAN TRADE MARK

# NEUMATIC CONVEYING SYSTEMS INCREASE ON, CUT CONTAMINATION FOR GOODYEAR

ecially engineered Fuller Airveyor® ems to handle pelletized rubber has d Rubber Company increase pro- re the latest Fuller design resulting rience in pneumatic conveying of pletely enclosed automatic systems nination problems and greatly re- e to spoilage.

rude rubber with Fuller Pneumatic lace of conventional rubber slab ey. One Airveyor system conveys the pelletizer to a weigh station, a r more systems operate from the spouts of the finish-run Banburys.

All of these Airveyor pneumatic conveyors are of the vacuum type, employing positive pressure exhausters for air supply. Each conveying system is equipped with its own individual bag-type filter, automatic in operation, which provides for 100% visible dust retention. Exhausters and filters are located on the roof. A control panel permits manual or automatic operation of the entire handling system.

If you are handling dry, bulk, granular materials, a Fuller Conveying System application-engineered to your process can be equally advantageous. Look to Fuller, whose range of products coupled with experienced know-how offers you the best *single source* for solving pneumatic materials handling problems. Just call or write Fuller today outlining your problem—no obligation, of course.

A-288
1954

**FULLER COMPANY**
**138 Bridge St., Catasauqua, Pa.**
Subsidiary of General American Transportation Corporation
Offices in Principal Cities Throughout the World

**Fuller**
....pioneers in harnessing AIR

**For more facts circle 656 on Reply Card**

# HOW DU PONT PUTS THE POWER OF COLOR TO WORK FOR YOU

Horace Jordan is a Du Pont "Color Counsellor"—one of a staff of specially trained sales representatives whose years of experience qualify them to bring you expert, on-the-job guidance in solving problems of maintenance painting. Let Horace tell you himself how Du Pont's system of Color Conditioning can put the power of color to work for you—at a profit:

"There are *two* ways you can economize on maintenance painting. Your first consideration, of course, is the selection of quality finishes. When you specify Du Pont paints, you're getting finishes that are tough, durable, just right for every job. Believe me, there's no better assurance of lasting protection and long-term economy.

"*Production* savings are something else again—a bonus you get when you paint according to Du Pont's system of Color Conditioning. You see, Du Pont developed this system to create ideal conditions of work or study in every type of plant and institution. Scientifically applied—often under our personal supervision—Color Conditioning harnesses the power of color to promote safety, raise employee morale, boost production. Result: *an extra bonus of savings!*"

If you'd like to discuss your maintenance painting problem with someone who knows his business, there's a man like Horace Jordan near you. Call him at your local Du Pont district sales office. For more information, plus the 28-page booklet, "How to Put Color to Work," write: E. I. du Pont de Nemours & Co. (Inc.), Finishes Division, Dept. PE-611, Wilmington 98, Delaware.

* * *

Horace Jordan is a paint expert whose 30 years of experience have helped him solve maintenance problems for a variety of institutions and industries. As a Du Pont "Color Counsellor," he's seen Color Conditioning pay off for countless plants, office buildings, schools, churches and banks. In demand as a speaker, he recently delivered—in a single month—*32* talks on color and its application, at the request of the Department of Home Economics of his state.

**DU PONT COLOR CONDITIONING PAINTS**

DU PONT

BETTER THINGS FOR BETTER LIVING . . . *THROUGH CHEMISTRY*

For more facts circle 523 on Reply Card

Photo Courtesy Bell Helicoptor Corporation, Ft. Worth, Texas

# TUFFY GIVES SLING USERS A "LIFT"

## in operating efficiency and economy

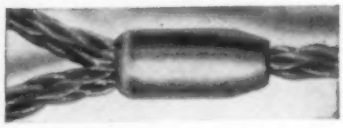
What else gets a lift with Tuffy? Just about everything. In every industry where loads are lifted, lowered, pulled or towed. On land and sea and even (as the picture suggests) in the air.

Jobs done by slings and hoist lines vary greatly. That's why Tuffy engineers have specialized in tailoring Tuffy products to specific uses.

Because of this specialization, Tuffy assures you the right sling for the job. Gives you better sling performance, greater safety and longer service life. In the long run, the ultimate low cost sling is Tuffy.

### Don't take less than these Tuffy advantages . . .

**Tuffy's secret of longer life:** patented 9-part machine-braided fabric. It provides a combination of flexibility and strength never achieved by ordinary wire rope. Amazing resistance to kinks, which smooth out easily when they do occur.



**An eye for strength and safety:** Tuffy's metal ferrule gives the eye splice full strength of the fabric. That's because it's pressed on under tremendous hydraulic power. What's more, the smoothly tapered body won't snag hands. A Tuffy extra at no extra cost.

### Get in Touch with Your Tuffy Distributor

Whether your sling jobs call for the Tuffy machine-braided sling, or Union's new 6- and 8-part hand-braided slings, your Tuffy distributor gives you by far the best buy. And he's famous for fast service on every sling and wire rope need. Look him up in the Yellow Pages.

## Tuffy® Tips

*—on safe use of*

**Slings and Hoist Lines**

### Lifting Strains Take High Toll of Injuries

Did you know that in some states one of every six compensation claims involves back injuries? And that one major insurance company says back injuries constitute 60% of their claim expense?

Hernia is another hazard of materials handling. One manufacturer reported 75% of his compensation claims involved hernias. This high incidence of hernias and back injuries can be greatly reduced by proper lifting equipment and methods.

### How to Play It Safe When Loading Slings and Hoist Lines

1. Keep pull on sling legs in a straight line never shorten legs with knots or I-bolts. If choker and basket hitches are used on slings, check rated load limits.
2. Load slings on the center of hooks. Never at their points, except for hooks specially designed for point loading.
3. Never use load hooks that are bent open. They have been overloaded, and may drop loads with disastrous results. Same goes for defective chain blocks. Insist that your men report them at once.
4. Lubricate wire ropes at regular recommended intervals, with lubricant advised by your local oil company engineer.

**FREE!**
**New Tuffy**
**Sling Handbook**

All about slings from A to Z, including types, dimensions and rated loads. Address **Union Wire Rope Corporation, 2272 Manchester Ave., Kansas City 26, Missouri.** Specialists in high carbon wire, wire rope, braided wire fabric, and stress relieved wire and strand.

6

**UNION** Wire Rope

ARMCO®

*Subsidiary of* ARMCO STEEL CORPORATION

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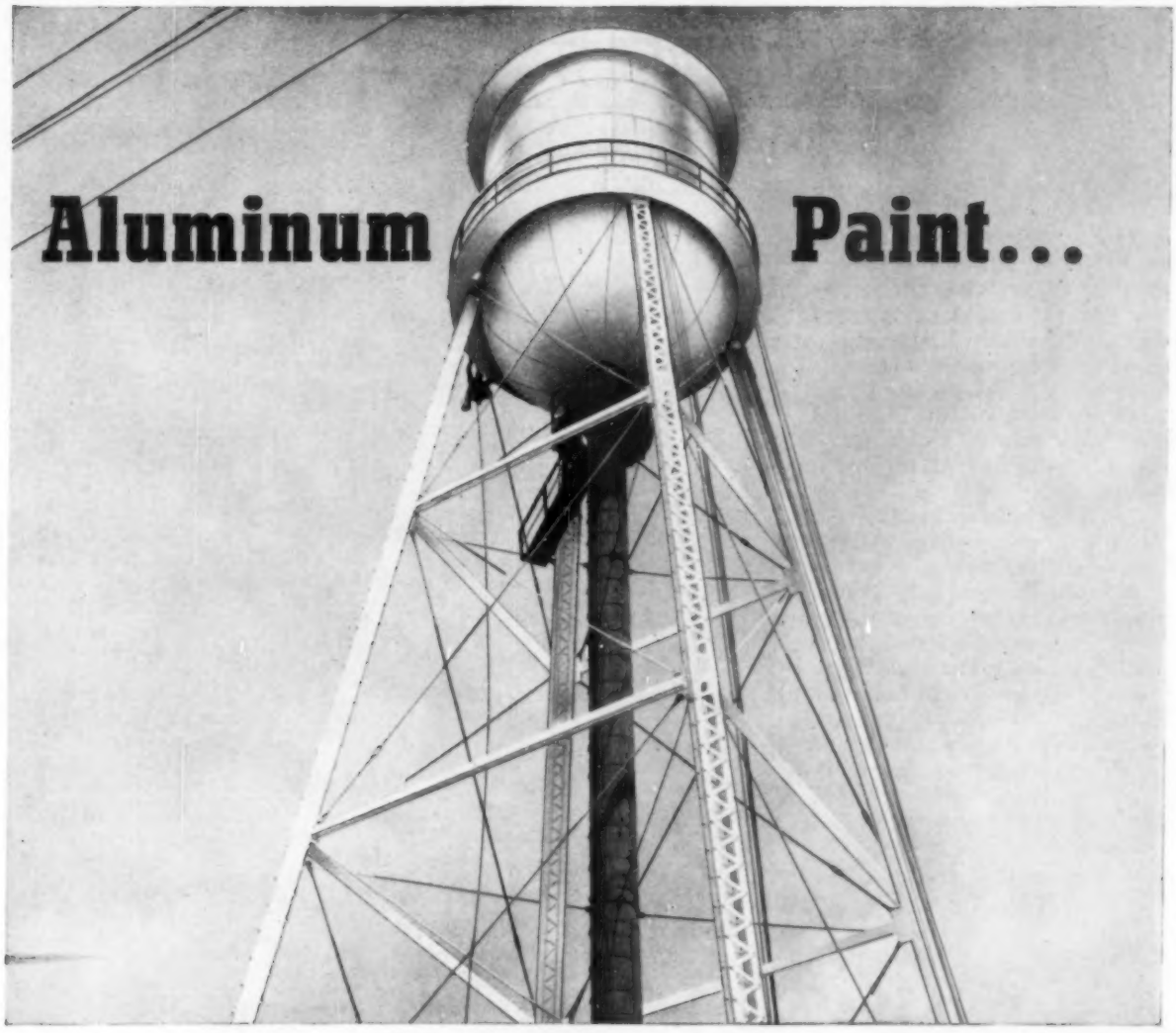
Armco Drainage & Metal Products, Inc. • The Armco International Corporation • Southwest Steel Products

**For more facts circle 524 on Reply Card**




# ...a bright spot in maintenance costs

The Finest Paints Made with Aluminum are made with REYNOLDS ALUMINUM PIGMENT

**Highly reflective, long-lasting aluminum paint prevents rust... resists corrosion... keeps costs down**

Paint made with Reynolds Aluminum pigment protects surfaces by forming a shield of pure aluminum. Weathering extremely well, this shield guards under-surfaces against rust, rot and corrosion. It's your best investment in low-cost preventative maintenance. And remember: aluminum reflects radiant heat to keep building and tank interiors up to 14° cooler, and to protect volatiles from evaporation. *Reynolds Metals Company, P.O. Box 2346-PL, Richmond 18, Virginia.*

# REYNOLDS ALUMINUM

Watch Reynolds new TV Show "Harrigan & Son", Fridays; also "All Star Golf", Saturdays—ABC-TV.

**For more facts circle 525 on Reply Card**

# PLANT ENGINEERS' DIGEST® so those who rush may read and know what's new

*Edited by Marjorie E. Weissman*

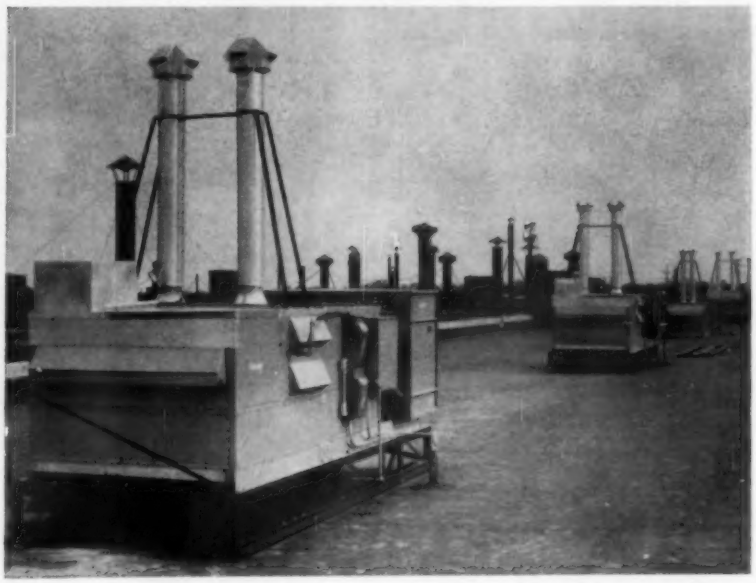
## Air Conditioning Units, Installed Astride Rails on Rooftop, Cool and Heat Offices

NINE ROOFTOP cooling and heating units for air conditioning the top floor of an office building in Rochester, N.Y. were installed by stages over a two-month period, without seriously disrupting office below.

Eight of the units produce 10 tons of cooling or 250,000 Btu of heating. The remaining unit produces 7½ tons of cooling and 200,000 Btu of heating.

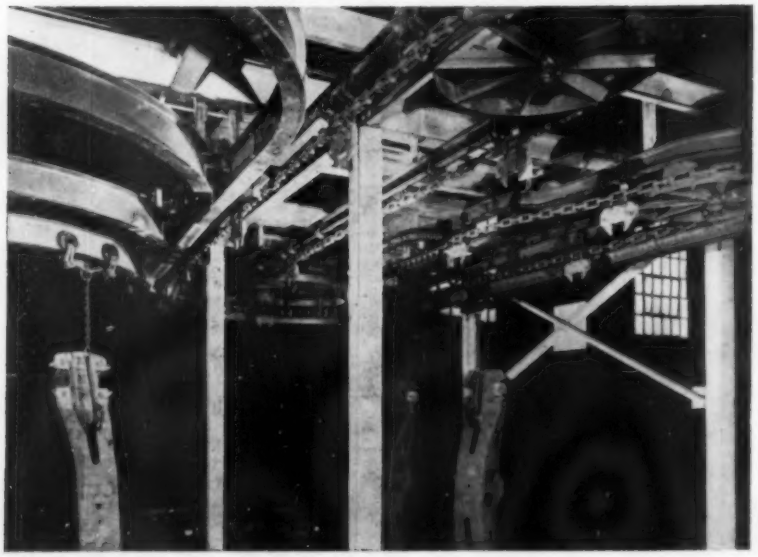
The plant engineer had planned to install water-cooled, packaged units within the work space, but this would have involved long runs of ductwork and the use of cooling towers. Because existing steam heated convectors under the windows provided no outside air and heated unevenly, he also planned to install steam coils in the packaged units for additional heating capacity.

The rooftop units solved or alleviated several of these problems. Their location reduced the noise level in the office; location over the center of the area to be air conditioned meant shorter ducts were usable. A simple damper admits outside air, which is filtered and condensate water is drained away by roof conductors. The units were installed on rails long enough to cross several roof supports. In this way, the 2700-lb weight of each unit was evenly distributed. *From a release of Carrier Corporation, Syracuse, N. Y.*



**Rooftop heating and cooling units solved office air conditioning problems.**

## Power-and-Free Conveyor System Moves and Stores Half-Ton Castings With Ease



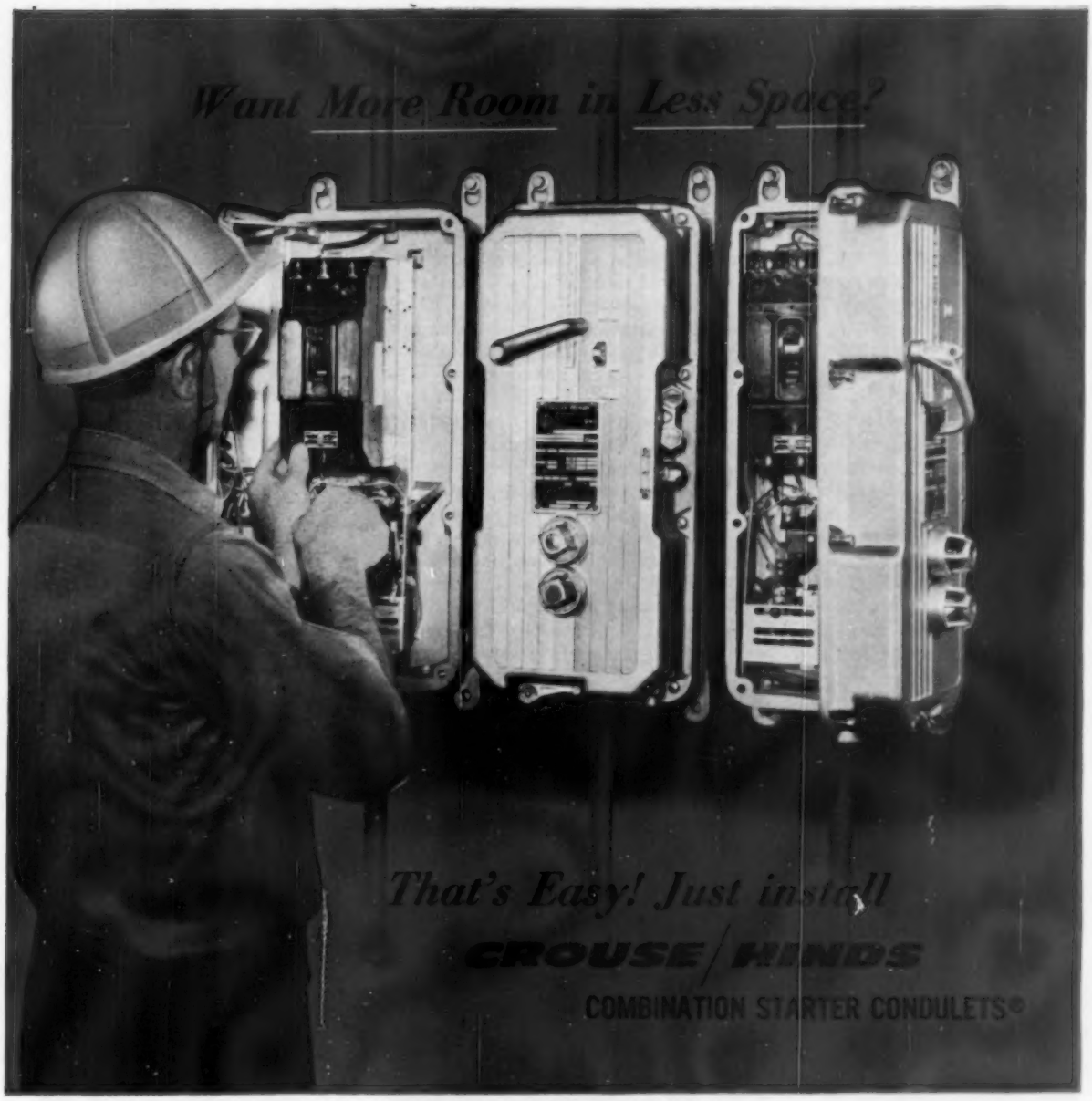
**Castings are selected from any of four storage lines, left, by operator who controls switching manually. Powered conveyor carries them to shot-blasting.**

BOLSTERS, SIDE FRAMES and yokes, made for the railroad industry by the Scullin Steel Co., of St. Louis, used to be handled from shakeout through processing on heavy steel skids transported by chain slings and overhead crane. To eliminate this multiple handling, straight line production utilizing a power-and-free conveyor system was introduced.

The power-and-free conveyors are a combination of powered trolley conveyor and unpowered monorail-type free conveyor. A circuitous free track connects all stations in the processing operations, and three powered conveyors move the castings along the free track from annealing to storage, to shot-blast area, to unloading area, and, if necessary, back to the shot-blast chamber.

The free track divides into four

(Continued on page 42)




Sure, they'll take any-make starter or circuit breaker. The door swings open right or left. Doesn't make any difference which. You always have plenty of room to work. And plenty of future capacity, too. Crouse-Hinds DMC/WMC's can be had with pilot-light holes, push-button holes, or selector-switch operating-shaft holes already drilled, tapped and plugged. Installation is always simple, fast, permanent. Dismounting just as easy, should you need to move to a new location.

Plenty of other advantages make for ease, endurance and economy. For example: Both the dust-ignition-proof DMC and the watertight WMC are strong, lightweight and corrosion resistant, made from top-quality *cast* aluminum. Each is designed for flexibility and for low-cost installation.

Ask your Crouse-Hinds Distributor for details. You can't go wrong. The dust-ignition-proof DMC conforms to National Electric Code Class II, Groups E, F, G and NEMA Type 9 EFG. While the watertight WMC conforms to NEMA Types 3, 3R, 4 and 5.

**CROUSE HINDS**
SYRACUSE NEW YORK

**OFFICES:** Atlanta Baton Rouge Birmingham Boston Buffalo Charlotte Chicago Cincinnati Cleveland Corpus Christi Dallas Denver Detroit Houston Indianapolis Kansas City Los Angeles Milwaukee New Orleans New York Omaha Philadelphia Pittsburgh Portland, Ore. St. Louis St. Paul Salt Lake City San Francisco Seattle Tulsa Washington
**RESIDENT REPRESENTATIVES:** Albany Baltimore Reading, Pa. Richmond, Va.
Crouse-Hinds of Canada, Ltd., Toronto, Ont. Crouse-Hinds-Domex, S. A. de C. V. Mexico City, D. F. Potenco, Sao Paulo, Brazil

**For more facts circle 526 on Reply Card**

# PLANT ENGINEERS' DIGEST

(Digest begins on page 40)

parallel cooling and storage lines, with switching arrangements at each end. Tracks are of side by side design, suspended from common supports and capable of storing at one time, 300 castings weighing 930 lb each. Each storage conveyor is equipped with a retarding chain conveyor, operating on 132-ft centers, which controls the speed and limits casting travel on the free run to 10 fpm.

After annealing, castings are loaded onto the conveyor system, are pushed manually along the free track of the four-wheel trolley assembly to a point where the assembly is engaged by the pusher bar of the powered trolley conveyor. This is an inclined pusher conveyor that elevates the castings to the highest point of the system—about 15 ft above floor level. Castings are sorted by type and directed by means of switches into any one of the four storage lines. This arrangement permits shot-blast operations on any type of casting, regardless of the order in which they are loaded into system. *From a release of Link-Belt Co., Chicago, Ill.*

## Timekeeping With Tape Recorder

HI-FI AND TAPE decks have been put to work as components in an automated timekeeping and cost accounting system in our plant.

When a production worker begins his day's assignment, he picks up a special telephone and reports his presence, his clock and job number and the time. The information "flashes" to the accounting office where it is automatically transcribed on magnetic tape by a recorder that was switched on when the worker picked up the telephone. Later, when he finishes his first job, the worker returns to the telephone, checks out the completed work and gives details on his next assignment. The procedure is repeated for each job change.

Under the old method, a worker was required to check with the timekeeper four or five times a day.

In the accounting office, "loaded" tapes are placed on a playback recorder and a timekeeper transfers the job data to the proper accounting record sheet.

**Special telephone circuit in plant transmits information between production and timekeeping departments. Detail of each job is taped.**

Telephones on the special call circuit are strategically located in the three buildings of the plant so that none is more than 25 ft away from the worker. Fifteen telephones, arranged in three circuits of five telephones each, have been installed.

In the office, a bank of recorders is ready to receive information phoned from the shop. A fourth recorder serves as a standby and is automatically activated if one of the three "ready" units fails to work. A call back circuit is provided for live, two-way communication between the time office and the shop floor. *From a release of National Electric Welding Machines Co., Bay City, Mich.*

## Communication System Leaves Hands Free for Work

**"Hands free" Bell Telephone communications system allows workers to talk back and forth between parts storage area and order office at new sales and service branch in Chicago area. Messages are broadcast through speaker, large arrow. Row of microphones, small arrows, pick up answers. (From a release of Yale & Towne Manufacturing Company, Philadelphia, Pa.)**

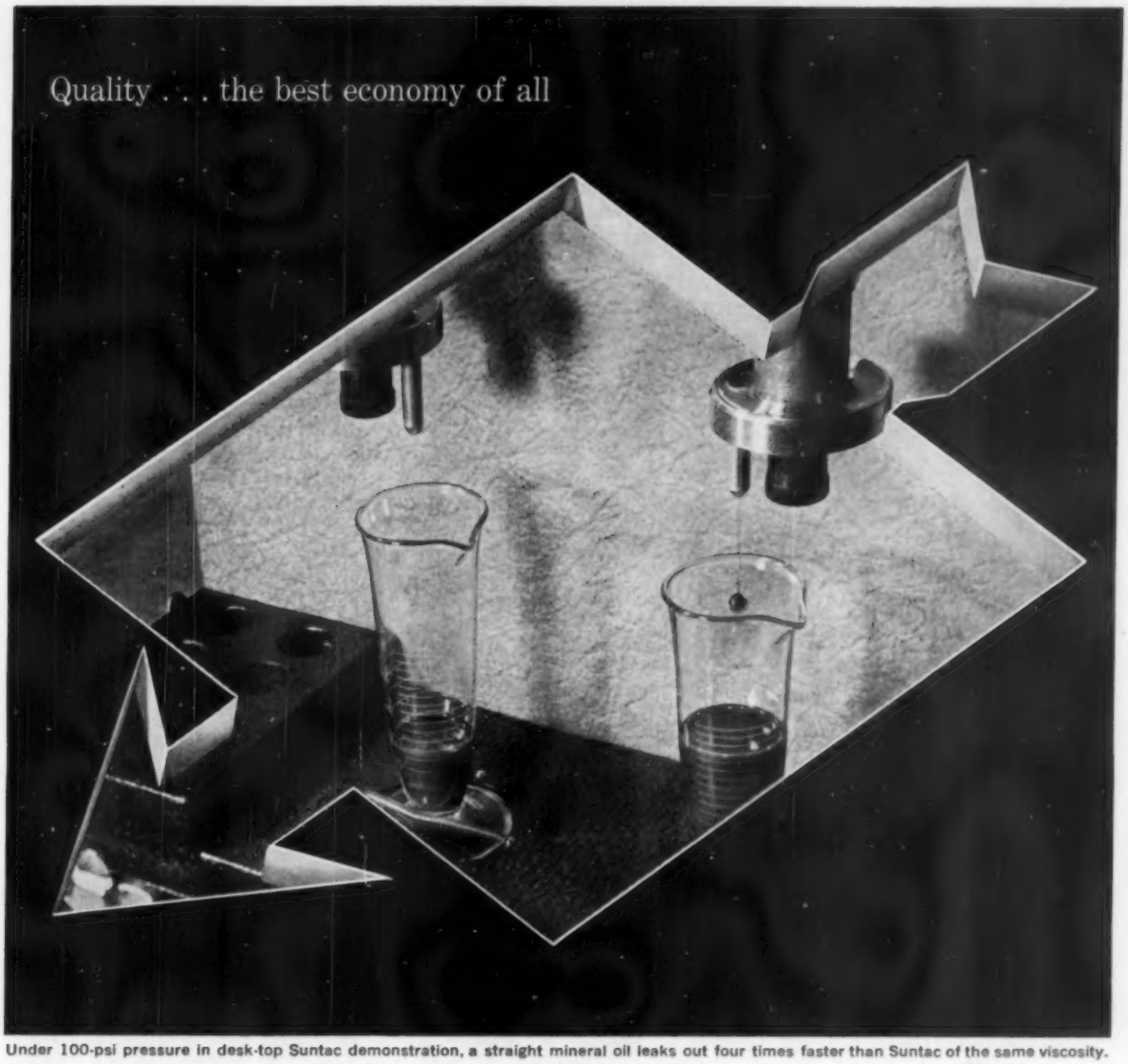
## Improved Mortar Mix Eliminates Weathering

AN AIR-ENTRAINING process that eliminates weathering of mortar joints in brick walls has been successfully demonstrated in our civil engineering department. Accordingly, the addition of any one of a number of chemicals that induce air entrainment, increases the durability of cement-lime mortars used in masonry construction. The research project was conducted with the cooperation of the Alpha Portland Cement Co., Easton, Pa.

Unexplainable failures in mortar such as cracking, leaking and mortarless joints, have been credited to such factors as excessive weathering, shrinkage, and expansion of mortars.

Knowing that the durability of

(Continued on page 44)




Under 100-psi pressure in desk-top Suntac demonstration, a straight mineral oil leaks out four times faster than Suntac of the same viscosity.

# You can cut oil leakage as much as 75% simply by switching to a Suntac oil

Don't cuss your "problem" leaker, don't look for a bigger drip pan—try a Suntac oil.

Suntac oils, besides their exceptional lubricating qualities, have the remarkable capacity to *stay put* instead of dripping out and making floors unsafe.

Match Suntac against the oil you're now using. Notice how its non-gummy antileak characteristic can reduce your oil losses as much as three-fourths. In fact, *many users report oil savings up to 90%!*

Have your Sun representative arrange for the five-minute demonstration shown above—right on your desk top. Or write for Suntac information to SUN OIL COMPANY, Phila. 3, Pa., Industrial Products Dept. PY-11
In Canada: Sun Oil Company Limited, Toronto & Montreal.

SUNOCO

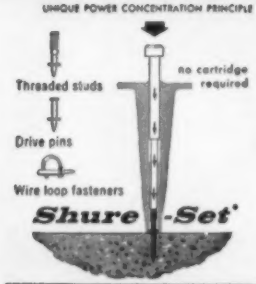
**MAKERS OF FAMOUS CUSTOM-BLENDED BLUE SUNOCO GASOLINES**

**For more facts circle 527 on Reply Card**

Cost-Conscious Maintenance Men Use SHURE-SET

FOR QUICKER FASTENING INTO CONCRETE

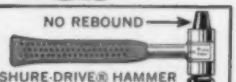
UNIQUE POWER CONCENTRATION PRINCIPLE




The unique "hammer-in" principle of the Shure-Set tool enables you to set threaded studs, drive pins and wire loops into concrete without muss, fuss, or waste. It is a tremendous work-and time-saver... requires no pre-drilling, filling, plugging or cartridge... just place fastener in tool, position against work face, then a few hammer blows drive fastener right through this metal or wood into concrete.

Shure-Set is simple, efficient, economical and *ten times faster* than ordinary light fastening methods. And remember Ramset for heavy-duty fastening. For your dealer's name look under "Tools" in the Yellow Pages, or write us direct for information.

NO REBOUND



NEW SHURE-DRIVE® HAMMER with Floating-Action

Newly-patented hammer actually absorbs shock, increases power and reduces worker fatigue. Ask for model R-400.

other products by

**Ramset® Fastening System**

OLIN MATHIESON Chemical Corporation — WINCHESTER-WESTERN DIVISION 294-K Winchester Ave. • New Haven 4, Conn.

For more facts circle 528 on Reply Card

# PLANT ENGINEERS' DIGEST

(Digest begins on page 40)

concrete is dependent on the introduction of entrained air, several field mortars were tested at field consistency to learn to what extent entrained air would affect their durability.

It was found that the addition of 11-13 per cent of air entraining agents prevented the 12 mortars tested from breaking up, even though they were subjected to extensive cycles of freezing and thawing. The same mortars, tested without the addition of the agent, were destroyed by no more than 26 cycles of freezing and thawing, and some by as few as five cycles.

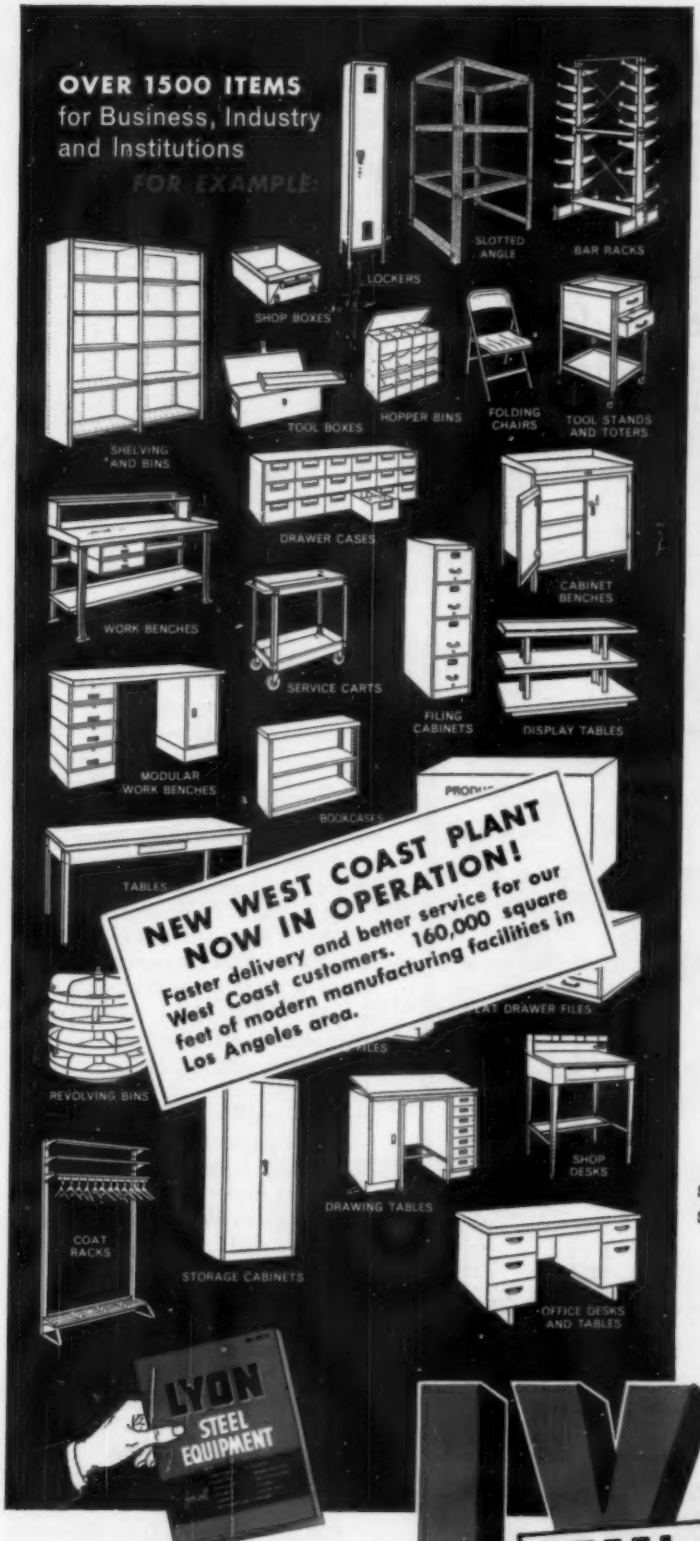
The soundness and specific gravity of limes do not change the durability of mortars enough to make lime a factor in obtaining a durable mix. Air entrainment was needed in all cases. *From a release of Lafayette College, Easton, Pa.*

## Magnets Convey Parts

**Permanent magnets welded on to rectangular frames handle up to 38,000 parts a day in our automobile assembly plants. Magnets replace 77 styles of hangers, can hold parts as large as 36-lb floor pan. (From a release of Chrysler Corp., Detroit, Mich.)**

## Neat Truck, Faster Work

MAINTENANCE MEN often lose valuable time because they can't find what they need in the jumble of materials carried in their service trucks. At one Southern company, a new system of uniform truck storage was developed, which has increased maintenance efficiency and lowered the cost of each job. Key




# DESIGN makes the DIFFERENCE

***...and top design is one of many dividends when you buy***

# QUALITY PROTECTED LYON STEEL EQUIPMENT

•

***THE "QP" ON EVERY LYON CARTON IS YOUR ASSURANCE OF QUALITY EQUIPMENT***

See your Lyon Dealer for delivery from stock of the world's most diversified line of steel equipment.

•

**LYON METAL PRODUCTS, INC.**

General Offices: 1191 Monroe Ave., Aurora, Illinois
Factories in Aurora, Ill.—York, Pa.—Los Angeles
Dealers and Branches in All Principal Cities

**THIS CATALOG ILLUSTRATES THE WORLD'S MOST DIVERSIFIED LINE OF STEEL EQUIPMENT**
***IT'S FREE!***

**LYON®**
**STEEL EQUIPMENT**

**For more facts circle 529 on Reply Card**

Nutting shows you "HOW"...

## the widest choice of floor trucks in the world can cut your costs!

For regular or "special" design floor trucks it pays to talk to Nutting *first*. Here's why: no other company makes more models, sizes or combinations of equipment than Nutting. Many times items which you may find listed as "specials" with other makes are regular equipment in Nutting's complete line. As a result you get "custom built" trucks at production line prices. You not only get overall lower prices; you also get the benefit of 68 years of experience, design "know-how" and modern manufacturing skills. To save valuable hours of your time and get the right equipment for your plant, talk to a Nutting representative *first*, for all your floor truck needs!

**Nutting makes over 1000 products, here are just 16 of them**

For appliances and finished products | Wagon trucks up to 10,000 lbs. capacity | All types of dollies for boxes & cases | For sub-floor & overhead drag lines

Trailers — up to 7,000 lbs. capacity | CASTERS — all types; WHEELS — demountable rubber tired, solid rubber, plastic & metal | Shelf and tray trucks | 2 wheelers for freight

Steel & aluminum frames for cases & cartons | Drag line trucks & trailers for palletless handling | Non-tilt platforms — Wood & steel frames | Shelf trucks for sub-assemblies

Dollies for cylindrical & odd shaped items | Triform & box trucks for packages & bundles | "Auto-Load" barrel & drum trucks | Tilt style platforms — Wood & steel frames

Dollar for dollar, feature for feature Nutting is your best floor truck buy. Write for your free copy of new Junior Catalog 59G.

Nutting

TRUCK AND CASTER COMPANY
Faribault, Minnesota

NUTTING TRUCK & CASTER COMPANY
492 Division Street • Faribault, Minnesota
Please send copy of Junior Catalog 59G.

NAME_____
COMPANY NAME_____
ADDRESS_____
CITY_____ STATE_____

For more facts circle 530 on Reply Card


# PLANT ENGINEERS' DIGEST

(Digest begins on page 40)

**Adjustable shelves and bins keep maintenance truck neat, increase efficiency. Stock is replenished daily.**

to this system of "stockrooms-on-wheels" is a new type of service truck shelving, consisting of inexpensive standard shelving components which are supplied in knocked-down form. Each unit has adjustable shelves and bin dividers, which permit wide variations in shelf height and width. The company's maintenance department assembled and installed the new units in only an hour and a half apiece.

Each truck is stocked uniformly according to a standard truck inventory card. Maintenance men charge off parts, as they are used, on a truck inventory card. Thus stock is easily replenished at the end of each day. Parts are found quickly by any man in the department, because each truck is stocked identically. Useless return trips to the central storeroom for missing items are eliminated.

Fragile items are stored safely in bins, where small items are also kept. Ladders, tool boxes, fixtures and large pieces of equipment are carried on the floor for easy handling. When trucks are replaced, the shelving is easily transferred to the new vehicle. *From a release of Penco Division, Alan Wood Steel Co., Oaks, Pa.*

## Corrosive Waste Handled By Stainless Pumps

CORROSIVE WASTE from the manufacture of fiberboard at the Mead Corporation Harriman Division, Harriman, Tenn., is pumped to the sewer by two sump pumps with stainless steel liquid ends.

The waste is an effluent consisting

# WRITE FOR THIS NEW BROCHURE..... TODAY!

## TECHNICAL BULLETIN ON INSULATING HEATED STORAGE TANKS SHOWS YOU . . .

- An easy way to figure how many btu's (and dollars) are now being wasted by your uninsulated tanks, vats and vessels.
- Latest lower-cost techniques of insulating large and small tanks.
- Why ULTRALITE, far more effectively than any other insulation, meets *all* the requirements for permanent and economical tank insulation.
- Why ULTRALITE-insulated tanks usually require *not one penny of maintenance* over the years!
- How ULTRALITE glass fiber insulation literally pays for itself . . . in some cases in just 6 months by saving over 90% of the heat now being wasted!

The new 8-page ULTRALITE Tank Insulation Brochure, we believe, offers the most comprehensive and current information available on the who-what-why-when-and-how of insulating tanks. Your free copy is available for the asking—just write today.

**GUSTIN-BACON** *Manufacturing Company* gb

232 West 10th, Kansas City, Mo.

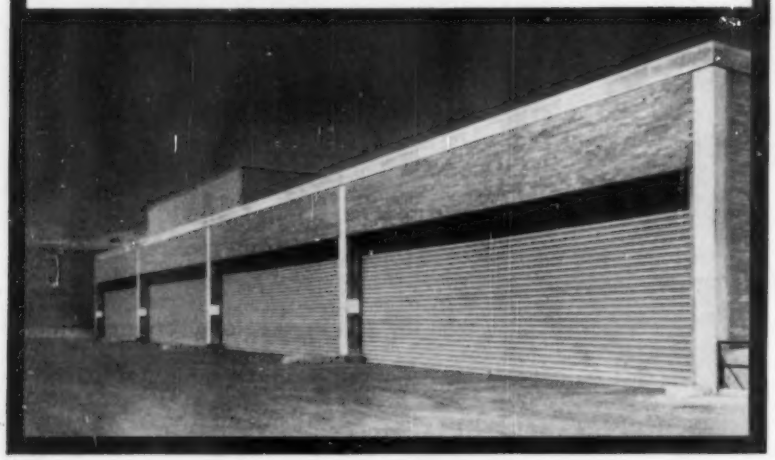
Thermal and acoustical glass fiber insulations . . . Molded glass fiber pipe insulation
Couplings and fittings for plain and grooved end pipe

For more facts circle 531 on Reply Card

now

MAHON ADDS A NEW DIMENSION TO ROLLING STEEL DOORS

...7-INCH WIDE SLATS FOR HEAVY-DUTY USE



Newest addition to the family of Rolling Doors from Mahon is a curtain design that fills a real need in many door applications. It uses 7-inch-wide interlocking slats of heavy (16- or 14-gage) Bonderized steel to provide *extra-long life in hard and constant usage.* These new Mahon Rolling Steel Doors have been proven-in-use to be economically and functionally ideal for industrial plants, railroad, truck and maritime warehouses and similar installations, particularly involving extra-wide door openings. Shown: Four of the new Mahon Doors—these are 48' 5" x 15' 6" sizes. Write for information.

MAHON BUILDS A COMPLETE LINE OF ROLLING DOORS IN GALVANIZED OR STAINLESS STEEL, ALUMINUM OR BRONZE—MANUALLY, MECHANICALLY OR POWER-OPERATED MODELS IN STANDARD, UNDERWRITERS' LABELED, OR SPECIAL TYPES.

**SEND FOR CATALOG G-60 OR SEE SWEET'S FILES.**

**THE R. C. MAHON COMPANY** *Detroit 34, Michigan*

MANUFACTURING PLANTS—Detroit, Michigan and Torrance, California
SALES-ENGINEERING OFFICES—Detroit, New York, Chicago, San Francisco and Torrance.
Representatives in all principal cities.

MAHON

For more facts circle 532 on Reply Card

# PLANT ENGINEERS' DIGEST

(Digest begins on page 40)

of water, chemicals, lignin and fiber.

The pumps are rated at 800 gpm at 50 ft head and are powered by 20-hp motors at 1150 rpm. They are float operated.

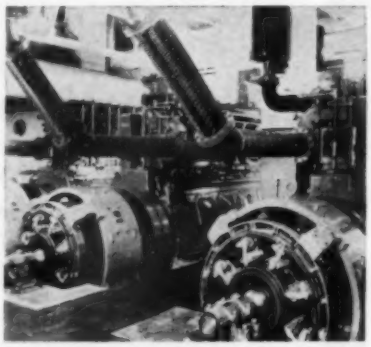
One pump usually handles all the corrosive liquid. The second pump starts automatically when the first pump cannot handle the entire flow. One pump working on a normal effluent flow runs about 53 per cent of the time, operating on-and-off at intervals of less than one minute.

The waste is pumped from the sump in the machine room basement into an underground sewer system through which it flows by gravity into a large outdoor collection reservoir. From there, it is pumped into the public sewer system.

The waste is treated with lime to control the pH factor at approximately 7.5 to 8.0. It is also screened over a ¼-in. square mesh screen to remove fiber particles. *From a release of The Deming Company, Salem, Ohio.*

## Diesel Vibration Reduced

STAINLESS STEEL vibration isolators, designed especially for diesel exhaust lines, solved a troublesome vibration problem in the power generating station of a southern chemical plant.



**Isolators installed between diesel engines and exhaust reduce vibration.**

Whenever the diesel generators were started, piping shook so severely that anchors were pulled loose from the sheet metal bulkheads, parting bulkhead panels at the seams. In addition, exhaust mufflers on the roof vibrated alarmingly until the engines were phased in.

Diameter of the flexible hose type

## HOW TO DESIGN A TRADEMARK

Why, it's easy as A-B-C. Just start with a simple shape, one that's readily identified and easily remembered. (The Jenkins Diamond is a good example.) Then just fill in the blank spaces. That's all there is to it, and almost anyone can do it!

# HOW TO MAKE IT MEANINGFUL

Ah, that isn't so easy nor so simple.

A trademark is like a man's signature: it can mean much or it can mean little.

*Time* and *performance* make the difference.

Take the Jenkins Bros. trademark. There's nothing tricky about the design, certainly nothing fancy about the words.

**Yet buyers and specifiers of valves everywhere know and respect this simple device, this mark.**

Why? Because in all the years since 1864 there has been no compromise in the *quality* of Jenkins Valves. We know it; you know it.

And that is the only way we know to make a trademark *meaningful*. That will always be the Jenkins way of making valves.

JENKINS®

*Jenkins Bros*

JENKINS BROS., 100 PARK AVENUE, NEW YORK 17

**For more facts circle 533 on Reply Card**

Are broken springs,
broken bolts,
or valve noises giving you
COMPRESSOR HEADACHES?

**here's why the simple design of the air cushion valve makes PENNSYLVANIA COMPRESSORS run efficiently...silently...with minimum maintenance.**

Stainless steel valve discs lift against a cushion of air in the simple, efficient design of the Air Cushion Valve that makes PENNSYLVANIA Compressors run so silently, so dependably, and with such low maintenance requirements. Air Cushion Valves have no nuts, bolts, or screws to break or burn fast. You get longer valve life . . . eliminate wear . . . eliminate noise caused by metal striking metal. Flat valve discs have no flexing or bending action to weaken or distort them. And the valve springs are highest grade stainless steel, rolled on edge, insuring maximum strength and durability. There is just one spring for each disc, and it bears evenly on the entire surface.

But this is only part of the PENNSYLVANIA story. Learn all the facts in "Compressors for Industry". It describes PENNSYLVANIA Compressors from 10 to 350 hp, horizontal, angle, and OILFRE models. Write to Dept. C-11 for your copy today.

**PENNSYLVANIA**
PUMP AND COMPRESSOR COMPANY
Easton, Pa. • Earning Customer Confidence Since 1920

**For more facts circle 633 on Reply Card**


# PLANT ENGINEERS' DIGEST

(Digest begins on page 40)

isolators matches that of the diesel exhaust pipe. In a length of 35 in. they will absorb vibration of up to 5/8-in. lateral and 1/2-in. axial total amplitude. Use of the isolators has attenuated the vibration while damage to roofing and bulkheads is avoided and plant noise level during startup, lowered. By reducing stress on piping connections, less maintenance is required for checking and tightening connections. *From a release of Allied Metal Hose Co., Long Island City, N. Y.*

## Dust, Bags Given Heave-Ho

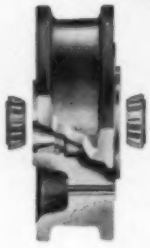
A TROUBLESOME DUST problem was solved and a better method of disposing of dusty paper bags was introduced with the installation of a new dust collector at Rust-Oleum Corp., Evanston, Ill.

A dry pigment loading operation is located on the third floor of the plant. Pigments are dumped from paper bags and gravity fed into processed fish oil. A considerable amount of dust is created in this operation, and both dust and paper bags are drawn into the duct work.

Bags and the dusty air enter a plenum chamber adjacent to the collector. The bags strike a baffle plate and fall to the bottom of a hopper where they are removed by a large rotary valve. The dusty air continues on into the collector. About 400 paper bags are disposed of daily. *From a release of Wheelabrator Corp., Mishawaka, Ind.*

**Dust collecting system makes short work of bags in which pigments are shipped and keeps the plant air clean.**

# It Costs Far Less to Build a Crane Locally from Wright Matched Components!



**TREAD WHEELS**
Made of special car wheel iron with the tread deep chilled to a hardness of 450-500 Brinell. Tapered tread is self-aligning.

**END TRUCKS**
Welded steel channel construction with heavy steel plate diaphragms. Squaring shaft of ground and polished steel.

**CRANE DRIVE UNIT**
Consists of electric motor and well-proportioned gear reduction. Solenoid "drag" brake. Size 1—motors up to 2 HP. Size 2—3 or 5 HP motor.

• Now, buy a dependable WRIGHT B-514 Top Running Single Bridge Crane the modern, money-saving way! Here's all you do! Instead of paying shipping costs on a complete crane, order only the matched components—from your nearby WRIGHT distributor. Then, buy heavy I-beam structurals from a local source. This way you realize big savings by greatly reducing freight charges. WRIGHT furnishes an information sheet showing structural components which can be bought locally to complete the assembly.

A FEW OF THE WRIGHT B-514 FEATURES:

**Controls** • Single-speed push button controls are furnished with fluid-drive models, variable-speed push button controls with models without fluid drive. Variable speed controls have five selective speeds for speeding and slowing crane travel.

**Fully Integrated Electrical Controls** for the B-514 assembled locally with a WRIGHT Hoist and WRIGHT Crane Drive Unit are factory-installed at no extra charge.

**Two Timken Roller Bearings** to each wheel. Placed in opposition to one another, they compensate for radial and thrust loads.

***GET IN TOUCH WITH YOUR WRIGHT DISTRIBUTOR***

*If you do not have his name, please write our YORK, PA., office and we will send it to you.*

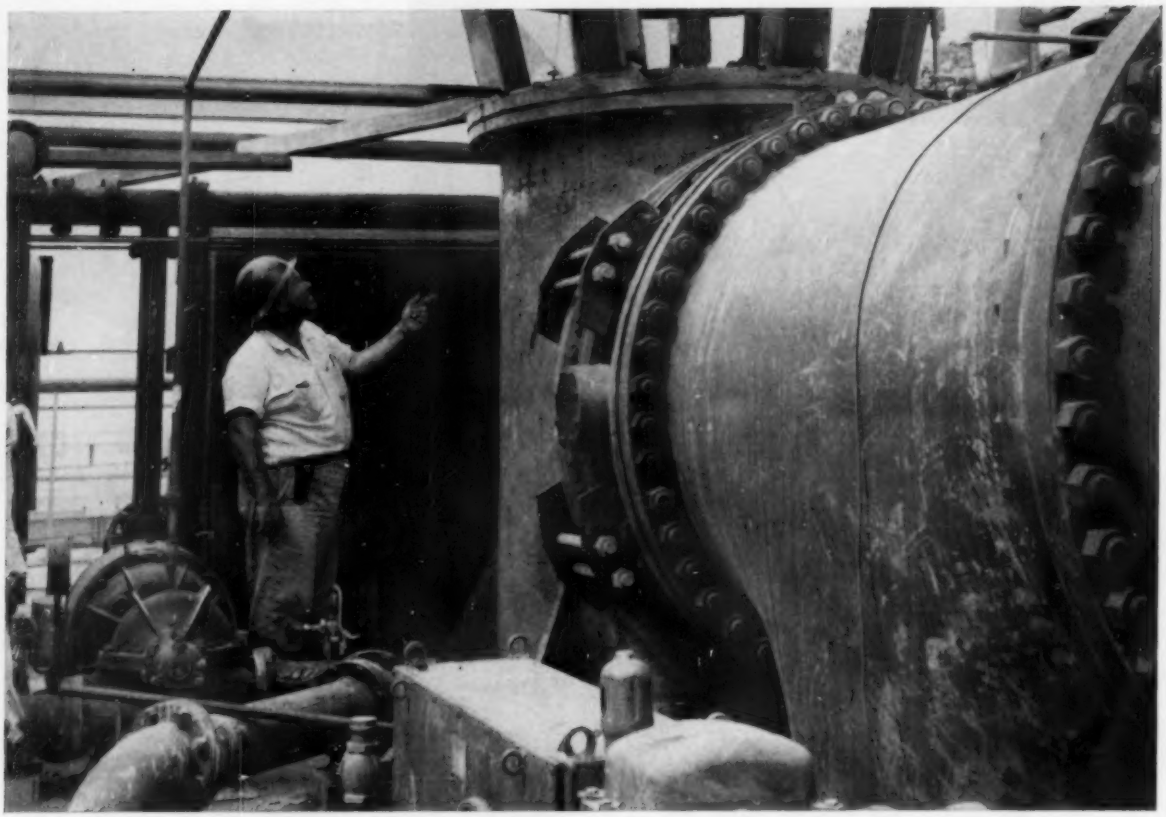
# WRIGHT CRANES

**Wright Hoist Division • American Chain & Cable Company, Inc.**

York, Pa., Atlanta, Chicago, Denver, Detroit, Houston, Los Angeles, New York, Philadelphia, Pittsburgh, San Francisco, Bridgeport, Conn.

**For more facts circle 535 on Reply Card**

ACCO



**Through this pipe 171 billion gallons of brackish water have passed...**

# Nickel Cast Iron provides strength, combats corrosion

Every hour of every day for the past three years, this pump has handled 6½ million gallons of water for the cooling and condensing systems of a Virginia power station. The water has a salt range of 11.4 to 27.2 parts per thousand.

Among the steps taken to assure economical equipment performance was the employment of 2% nickel cast iron for the huge pump column, diffuser bell and elbow. The divided water boxes in the condenser are also made of 2% nickel class 40 grey iron.

### Nickel improves properties

The nickel cast iron provides improved tensile and compressive strengths over regular grey iron. It helps assure a uniformly dense grain structure, increasing pressure tightness. It also affords greater resistance to graphitic corrosion.

Through the use of Nickel, alone or in combination with other alloying ingredients, the engineering properties of cast iron can be controlled to meet many combinations of service requirements. Would you like complete information? Write us for a copy of "Engineering Properties and Applications of Nickel Cast Iron." A postcard will do it.

**THE INTERNATIONAL NICKEL COMPANY, INC.**
67 Wall Street INCO New York 5, N. Y.

**TYPICAL ENGINEERING PROPERTIES OF NICKEL CAST IRONS**

| Class | 30 | 40 | 50 | 60 |
|---|---|---|---|---|
| Tensile Strength, p.s.i., min. | 30000 | 40000 | 50000 | 60000 |
| Compressive Strength, p.s.i., min. | 110000 | 130000 | 145000 | 165000 |
| Torsional Strength, p.s.i., min. | 34000 | 47000 | 60000 | 73000 |
| Modulus of Rigidity, p.s.i., typical | $5x10^6$ | $5.6x10^6$ | $6.2x10^6$ | $6.8x10^6$ |
| Impact Strength, Izod AB, ft.lb.*, typical | 26 | 35 | 43 | 52 |
| Hardness BHN, typical | 200 | 230 | 260 | 290 |

*The numbering system is similar to that used in A.S.T.M. Spec. A48-48.

# INCO NICKEL

NICKEL MAKES CASTINGS PERFORM BETTER LONGER

**For more facts circle 536 on Reply Card**

# ON CORROSIVE JOBS

# EXTEND FAN LIFE 3 TO 12 TIMES

By "welding" rubber to all metal parts of a fume fan, Buffalo Forge extends fan life 3 to 12 times. Certainly, where you handle highly corrosive fumes, there is no more economical way than with these 'Buffalo' rubber-lined fans. The extra cost for the lining is repaid many times in longer service without downtime losses for replacement.

**Other Corrosive Applications** may not require rubber-lined fans. Special coatings, stainless steels and other materials are often adequate for the fumes exhausted. For example, 'Buffalo' builds resin-bonded fiber glass fans which are both corrosion and impact resistant to temperatures up to 225° F.

**For Every Condition,** you can depend upon Buffalo Forge for effective, efficient and economical answers to your air handling problems.

**Write today for Bulletins** 2424-F and FI-511, outlining the chemical characteristics, volume and pressures of fumes to be exhausted — or call your nearby 'Buffalo' Engineering Representative.

"Buffalo"

**AIR HANDLING DIVISION**

**BUFFALO FORGE COMPANY**

Buffalo, New York

Canadian Blower & Forge Co., Ltd., Kitchener, Ont.

*'Buffalo' Air Handling Equipment to move, heat, cool, dehumidify and clean air and other gases.*

*'Buffalo' Machine Tools to drill, punch, shear, bend, slit, notch and cope for production or plant maintenance.*

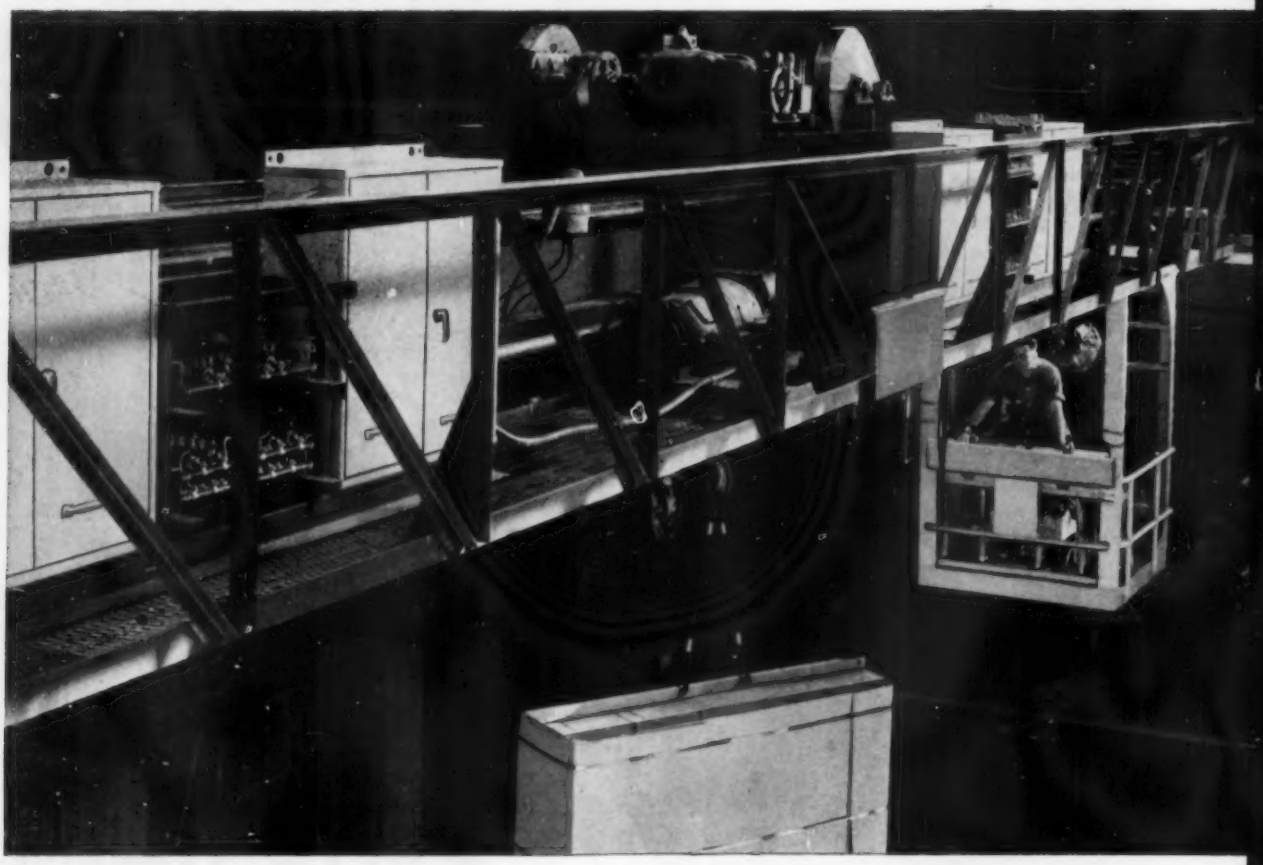
*'Buffalo' Centrifugal Pumps to handle most liquids and slurries under a variety of conditions.*

*Sawier Machinery to process sugar cane, coffee and rice. Special processing machinery for chemicals.*

**For more facts circle 537 on Reply Card**

*With General Electric's Complete "7400 Line"*

# GET STEPLESS



Now you can have *completely* stepless crane control —from full-speed lowering to full-speed hoisting— plus extremely accurate spotting. And this is just part of the story on General Electric's new "7400 Line." You also get substantially reduced maintenance: static devices are used in the control circuit to eliminate secondary contactors, relays and other moving-part components. Once energized, the IC7406 control can be operated through an entire hoisting and lowering cycle without a single control-panel component moving!

The "spotting zone" illustrated on the performance characteristic chart above is the operating area where accurate handling of valuable loads is most important. And this is where General Electric's IC7406 control really pays off! You can stop, momentarily hold, or reverse the load at "creeping" speed—without jogging!

General Electric's complete line of a-c crane controls also includes regulated and non-regulated control, both utilizing static components. Get the full story on the G-E "7400 Line" by contacting your G-E Apparatus Sales Office, or mail the coupon today!

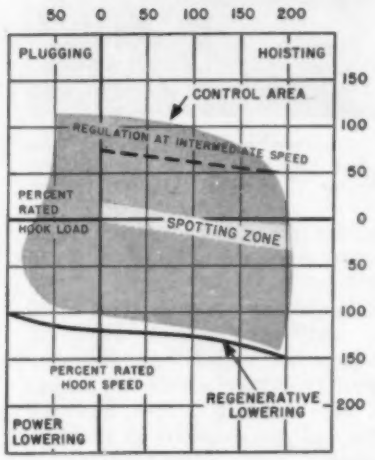
*Progress Is Our Most Important Product*

GENERAL ELECTRIC

*of AC Reactor Crane Controls You Can . . .*

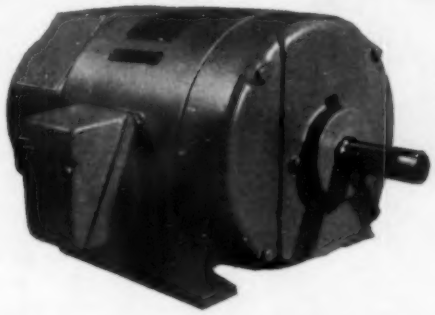
# SPEED CONTROL

## COMPARE THE PERFORMANCE AND FEATURES OF GENERAL ELECTRIC'S AC CRANE CONTROL




**PERFORMANCE CHARACTERISTICS of General Electric's IC7406 static crane control.**

| COMPARE THESE FEATURES: | G-E IC7406 | "A" | "B" | "C" |
|---|---|---|---|---|
| Reverses statically with no moving parts | ✓ | | ✓ | |
| All magnetic components—no electronic tubes | ✓ | | ✓ | ✓ |
| Balanced motor currents | ✓ | ✓ | | |
| "Spotting zone" control for accurate positioning | ✓ | | | |
| Control from one master switch | ✓ | ✓ | | ✓ |
| Completely stepless control | ✓ | | | |
| Total number of power contactors | 1 | 2 | 3 | 8 |
| Total number of relays (excluding overload relays) | 2 | 4 | 6 | 13 |
| Eliminates secondary accelerating contactors and relays | ✓ | ✓ | | |
| Eliminates need for both electrical and mechanical load brakes | ✓ | | ✓ | ✓ |
| Trolley collectors required | 9 | 10 | 10 | 10 |
| Flat speed-torque characteristic on *all* master switch positions | ✓ | | | |



**NEW TRI CLAD* WOUND ROTOR MOTOR**

General Electric's new Tri/Clad "55" wound rotor motor now makes it possible to substantially cut motor and control costs on crane applications.

Up to 59% smaller and 49% lighter, this new motor development packs more horsepower into a given frame size than any standard Class-A insulated wound rotor motor available. And—lower secondary currents reduce control equipment costs.

These motors are available in ratings from 5 to 150 horsepower in dripproof, TENV or TEFC enclosures. G.E.'s new convertible design allows increased flexibility and reduced warehousing costs. Type MR dripproof motors may be converted to TENV motors simply by adding endshield covers and changing the pulley endshield.

*Registered Trade-mark of General Electric Company.

**MAIL THIS COUPON TODAY**

**Sect. K785-11**
**General Electric Company**
**Schenectady 5, N. Y.**

**Please send me full information on General Electric's new "7400 Line" of AC crane controls, and new Tri/Clad wound rotor motor.**

Name_____

Company_____

Street_____

City_____

State_____

**For more facts circle 538 on Reply Card**

# OPERATION AND PRODUCTION® pointers for the industrial plant engineer

*Edited by Vern Kempf*

## Air Conveying Doubles Capacity

AUTOMATION of materials handling at Faultless Milling, Springfield, Illinois, coupled with new blending and storage facilities has doubled the feed mill capacity while reducing production costs. New facilities provide for bulk ingredient handling and automatic, electronically-operated batching and mixing.

Formerly, bagged materials were unloaded manually from freight cars and trailer trucks, moved by hand trucks to the storage area and then later trucked to the mixing site. After mixing, feeds were packaged and transferred to the shipping room. If they needed further processing, they had to be transferred to the processing machines and then to the shipping room.

These multiple handling operations increased the possibilities of breakage and spillage loss. Fifteen men were needed and because production requirements demanded that three to four hundred tons of bagged material be kept on hand, space had to be provided for up to 8000 bags.

Heart of the new materials handling system is two pneumatic systems of the vacuum type manufactured by the Fuller Company, Catasauqua, Pa. One unloads box cars and covered hopper cars and the other unloads trucks and also transfers bagged ingredients and premixes from the mill to the new 150 ft storage and blending tower.

The car unloading system unloads up to 24 of the 45 ingredient storage bins in the new tower at a capacity of 40 tons per hour. The transfer system delivers material to any of the 45 bins at a capacity of 15 tons per hour. The air conveying system works well with the wide variety of materials handled. This includes wheat mill, soy bean meals, fish solubles, alfalfa and oat products and basic minerals such as salt, calcium and phosphate.

## Epoxy Saves Problem Motors

SAVINGS running into thousands of dollars annually have been realized by Pittsburgh Coke and Chemical Company, Neville Island, Pa., in the maintenance of just 15 motors. These motors drive coke conveyor belts and chemical and water pumps.

**Five-horsepower motor driving conveyor belt section is examined by Walter T. Wright, chief electrician.**

Ranging in size from three to 60 hp and including both totally-enclosed, fan cooled and explosion-proof types, the motors are subject to high moisture, intense dust and chemical contamination in their operation.

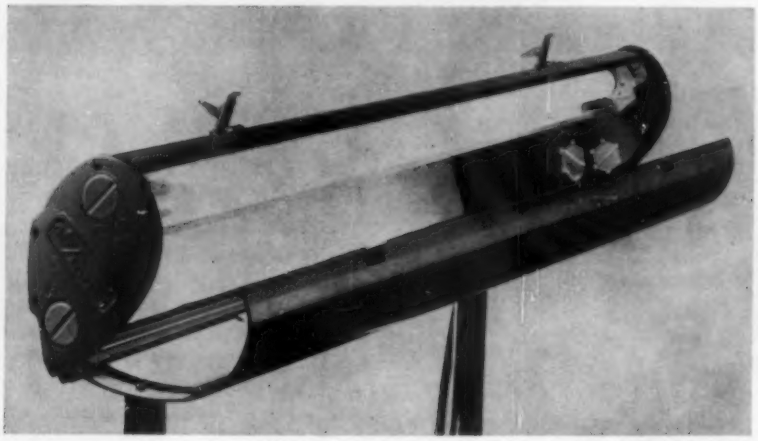
An example is a five-horsepower, Class B insulated motor located in a partially-enclosed structure above a conveyor belt, moving freshly quenched coke from the coke production plant to storage bins. Steam condensation causes intense moisture concentration in the confined area which is also subjected to coke dust. Under these conditions, the motor failed frequently and it was necessary to remove it for rewinding.

This cost the company not only the expense of rewinding the motor, but also the time of several men who were required to remove the motor from its restricted quarters. An additional expense was the downtime experienced until a substitute motor could be installed.

To solve this problem, Walter T. Wright, Chief Electrician, consulted with the Manufacturing and Repair Division of Westinghouse Electric Corporation. Upon recommendation of Westinghouse engineers, a solventless epoxy protective encapsulation was applied after rewinding the motor. Designed for problem motors

(Continued on page 58)

## Computor Predicts Performance of New Lighting Design



**Compact lighting system with a brightness level 338 per cent greater than any fluorescent unit commercially available was introduced recently by Sylvania Lighting Products, a division of Sylvania Electric Products, Inc. Utilizing a fluorescent aperture lamp, the new unit uses an optically precise fixture to punch a sheath of light evenly across the area to be illuminated. Complicated mathematical calculations required to produce specifications for installations of this system are accomplished by using IBM's Fortran (formula translation) equipment and processing data through an IBM 650 computer at Sylvania's divisional headquarters at Salem, Mass.**

Most accurate of all mechanical variable speed drives:

# positive P.I.V.

## Infinitely Variable

For stepless, slipless speed changing, there's nothing like Link-Belt P.I.V.—the *only* chain-driven variable speed drive.

With P.I.V., teeth—not tension—assure positive, high-efficiency power transmission. You can select any speed in its range—find it instantly, hold it indefinitely. The exclusive all-metal, self-tooth-forming chain meshes with radially grooved wheels . . . maintains positive, nonslip contact at any speed under all loads.

P.I.V. drives are fully enclosed . . . unaffected by atmospheric conditions. They're available in 8 sizes, 16 standard types, capacities from ½ to 25 hp. Type RS is available in capacities up to 50 hp.

For full details, ask your Link-Belt district sales office or authorized stock-carrying distributor for Book 2274. You'll find them in the yellow pages of your local phone directory under Power Transmission Equipment.

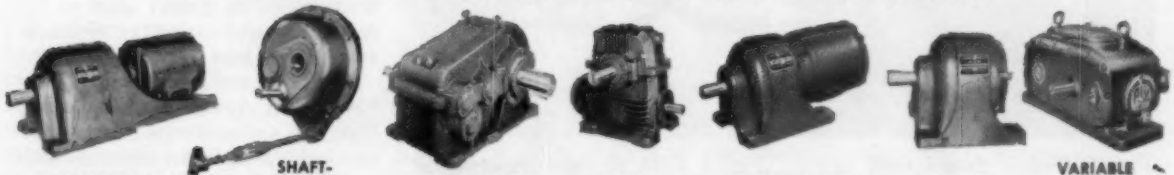
**INSTANT SPEED CHANGING** is achieved by simply turning handwheel to desired position on easy-to-read dial. P.I.V. drives are also available with electric, pneumatic or hydraulic controls. Here P.I.V. drive and Link-Belt roller chain accurately regulate speed of rolls in roller-hearth furnaces used to heat-treat jet engine parts.

LINK-BELT

LINK-BELT COMPANY: Executive Offices, Prudential Plaza, Chicago 1. To Serve Industry There Are Link-Belt Plants, Warehouses, District Sales Offices and Stock Carrying Distributors in All Principal Cities. Export Office, New York 7; Australia, Marrickville (Sydney); Brazil, Sao Paulo; Canada, Scarboro (Toronto 13); South Africa, Springs. Representatives Throughout the World.

10,340

**LINK-BELT has the right reducer for every need, every speed**



MOTOGEARS | SHAFT-MOUNTED | PARALLEL SHAFT | WORM | GEARMOTORS | IN-LINE | VARIABLE SPEED

For more facts circle 539 on Reply Card

# OPERATION — PRODUCTION

(O and P begins on page 56)

which must operate in high humidity atmospheres, the epoxy has low viscosity which enables it to completely penetrate the interstices of the windings, as well as the slots.

The motor that formerly failed with frequent regularity continued in operation for a period of 14 months with the epoxy encapsulation. Mr. Wright reports that the failure then was due to a fuse blowing, resulting in a circuit overload with consequent burning of the motor windings.

## Meter Tracks Down Noise Source

WHEN THE Harold E. Shugart Company, Inc., of Glendale, California, says a building is too noisy, no one has to take their word for it. They prove it. Engineers of this acoustical engineering and contracting firm back up their judgment with readings from a versatile sound-measuring instrument which accurately determines both noise levels and frequency characteristics.

The instrument is a portable device with a self-contained power supply. It combines the functions of a sound level meter, octave band analyzer and narrow band analyzer. A removable goose-neck microphone adds to its flexibility. The instrument was developed by engineers of Mine Safety Appliances Company, Pittsburgh, Pa.

**Noise level in air conditioning compressor room is checked with sound instrument after acoustic treatment.**

Shugart engineers used the meter, called a Soundscope, in a survey of the Blue Cross Building in Los Angeles. Here the problem was sound transmission from the compressor and machine rooms to offices on other floors. After the compressor room was treated in accordance with Shugart's recommendations, the sound level dropped from 110 decibels to from 82 to 88 decibels.

## Scanner Controls 24 Welders

ELECTRONIC scanning pulses, traveling from one machine to another at a speed of 120 millionths of a second, are masterminding welding operations at Chrysler Corporation's stamping plant, Twinsburg, Ohio. Called the "Magic Wand," the system makes sure that all the welded automobile bodies coming off the production line are solid, metal-fused integral units.

This electronic brain scans 24 electrical welding units 320 times every second and permits individual firing of the 24 units so fast that the human eye cannot detect the intervals. In this way, more than 860 spot welds are created to form the rails and the floor pan assemblies of almost all the corporation cars.

The electronic system was a necessary adjunct to the automated assembly line because welding operations required such tremendous amounts of electrical power. If two giant welders fired simultaneously, excessive voltage drop would seriously affect weld quality. The total demand of all 24 machines is 90,000 kva.

There is always a certain amount of inherent slowness in an automated assembly line and certain machines react quicker than others. If a given machine fails to fire and send in a finish signal within a three-second interval, the scanner turns on a red warning light and moves on to fire other welding machines.

If any portion of the automated line cannot be repaired in a few minutes, the entire assembly operation is shifted to a duplicate assembly line with the same number of welding machines and the same electronic brain to command it.

Manufacturing engineers point out that the use of the electronic scanner

## Central Dust Collecting System Saves Heat Normally Exhausted in the Winter Months

**Fig. 1. Buffing fixture used to remove excess flash on rubber "O" rings.**

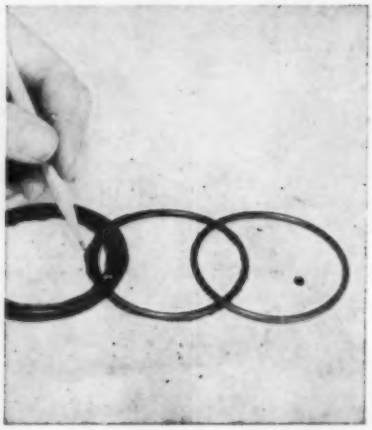


**Fig. 2. Left to right, molded "O" ring, after tumbling and after buffing.**

INSTALLATION of a central dust control system at Precision Rubber Products Corporation, Dayton, Ohio, eliminated eight unit dust collectors and improved the operational effectiveness of the dust control system. The central system is arranged so that it can exhaust clean air outdoors or return it to the plant. The ability to select the alternative best suited to weather and temperature conditions results in greater comfort for employees and saves considerable amounts of heat in winter months.

Designed and manufactured by Pangborn Corporation, Hagerstown, Md., the new system exhausts 5175 cfm and features a fire-resistant cloth bag dust collector.

makes sure that every welding machine receives the same charge of electricity each time it welds, thereby assuring consistent quality in the welding operation.

To make this assembly line run smoothly, the Chrysler Corporation owns and operates its own outdoor substation which steps power down from 132,000 volts to 13,200 volts for distribution underground to unit substations located throughout the plant.

## Drill Press Swages Tubes Faster

MECHANICS at United Air Lines' Engineering and Maintenance Base, San Francisco, formerly swaged about 125 tube ends per hour in oil coolers using a portable swaging tool. By using a standard 17-in. Delta drill press, they have been able to perform this job at the rate of 250 tube ends per hour.

A simple block casting, bored to fit the drill press column, has been

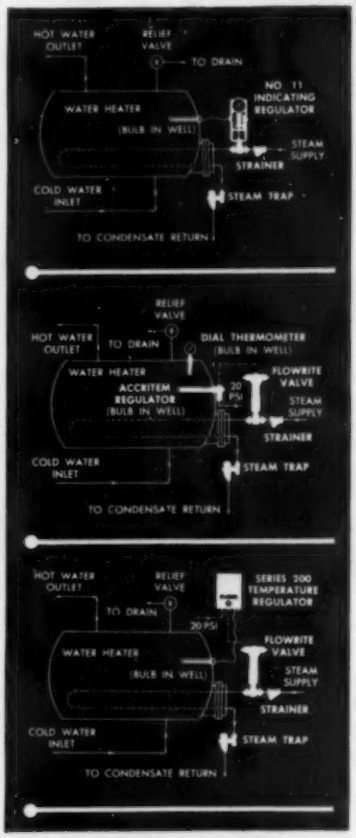
**Replacing slow hand process, drill press swages tube ends in oil coolers at rate of 250 tube ends per hour.**

added between the drill head and motor so that the spindle will reach any point on the face of the cooler. A longer belt was substituted for the standard belt to allow for the addition of the nine-inch extension of the throat capacity of the drill press.

## Steel Belt Tackles Tough Job

A HINGED-STEEL conveyor belt has supplied the answer to a tire manufacturer's problem of moving heavy, high temperature rubber compounds through the manufacturing process. Installed in the Tupelo, Miss., plant of Pennsylvania Tire Company, the


# Practical Ways To Control Hot Water Storage Heaters

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These diagrams, plus clear and concise information on storage heater control, are available to you without obligation as part of the Powers *Engineer's Manual, Steam-Water Service.*

This manual has been specially prepared for plant use. It is available free to personnel whose job function covers operation and/or installation of steam-water service. Various control systems described and illustrated include: domestic hot water . . . instantaneous heat exchangers . . . heat exchangers for cooling . . . fuel oil heaters . . . pressure reducing . . . jacket water cooling . . . two-temperature hot water systems.

Send for your Engineer's Manual now! If you have a special requirement or problem ask for recommendations.

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DON'T expect fire and breakage protection from ordinary window glass.

Only glass containing wire mesh qualifies as a fire retardant and enjoys recognition in most state and municipal codes as a safety factor in glazing openings in windows, skylights, partitions, exit doors and other vital areas in buildings.

DO EXPECT MAXIMUM SAFETY and PROTECTION FROM MISSISSIPPI WIRE GLASS . . .

the glass that helps "bottle up" fire . . . the original solid wire glass that is today the standard by which all others are judged.

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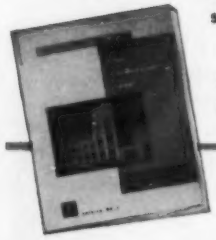

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WORLD'S LARGEST MANUFACTURER OF ROLLED, FIGURED AND WIRED GLASS

For more facts circle 541 on Reply Card

## OPERATION—PRODUCTION

(O and P begins on page 56)

**Heavy, high temperature rubber compounds fall on steel conveyor belt with a force in excess of 1000 lb.**

conveyor has been in continual operation for six months and has needed no maintenance other than cleaning and lubrication.

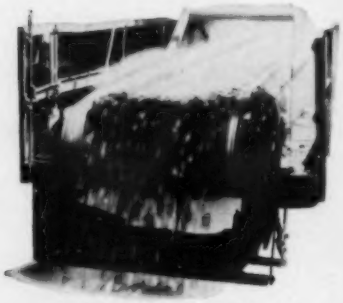
In the Pennsylvania Tire plant, ingredients in a Banbury mixer are formed into a semi-soft pliable mixture which falls a distance of three or four feet to the conveyor below. The weight of the falling batch averages about 325 lb and exerts better than 1000 lb of force when it hits the conveyor. The material emerges at a temperature ranging from 260 to 275 F. The hinged steel conveyor, produced by May-Fran Manufacturing Company, has helped solve this tough job.

### Rectifier Conserves Floor Space

DESIGNED into a three-story building, 72 ft long by 24 ft wide, a silicon rectifier system will furnish the power for Hooker Chemical Corporation's new chlorine-caustic cell line facility at Niagara Falls, New York. Tiered to a three-story height, the silicon rectifier system occupies less than half the ground space normally required for a system of this type.

Hooker Chemical Corporation and General Electric engineers worked together in designing the compact system. The first floor, open on three sides, will house induction voltage regulators, rectifier transformers and connecting busses. Rectifiers, heat ex-

# WHEN YOU NEED RESILIENCE PLUS...



**RESISTANCE TO HEAT**

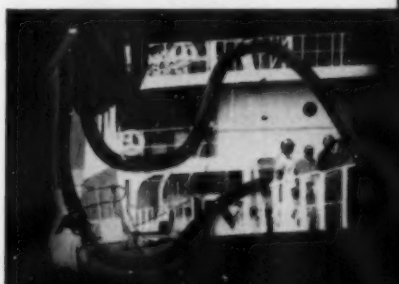
A million tons of hot coke have not harmed this neoprene belt.

**RESISTANCE TO FLAME**

Neoprene coated firewalls for aircraft pass this flame thrower test.

**RESISTANCE TO COLD**

Neoprene remains flexible even at –65° F.



**RESISTANCE TO OIL**

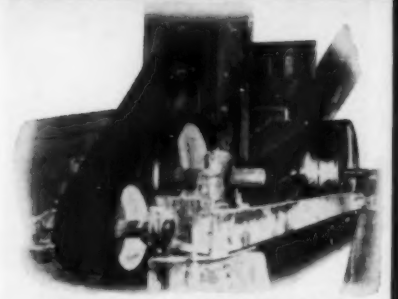
Neoprene retains its properties in contact with oil and grease.

**RESISTANCE TO SUN AND WEATHER**

After 25 years' exposure, neoprene cable (bottom) shows no surface cracking.

**RESISTANCE TO OZONE**

Neoprene tire sidewalls resist ozone cracking.

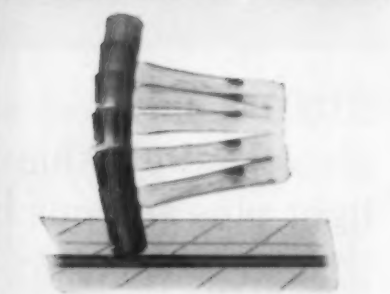


**RESISTANCE TO ABRASION**

Tough neoprene gives dependable service in severe applications.

**RESISTANCE TO CHEMICALS**

Neoprene assures protection against most acids and chemicals.



**RESISTANCE TO IMPACT**

Neoprene has outstanding resilience, resists permanent distortion.

# SPECIFY VERSATILE DU PONT NEOPRENE

synthetic rubber

A quarter century of industrial service has proven that versatile Du Pont neoprene, with this balanced combination of properties, can meet a range of severe service requirements. Neoprene products are available from rubber goods manufacturers and distributors. For additional information, write E. I. du Pont de Nemours & Co. (Inc.), Elastomer Chemicals Department PE-11, Wilmington 98, Delaware.

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BETTER THINGS FOR BETTER LIVING...*THROUGH CHEMISTRY*

NEOPRENE MAKES TODAY'S PRODUCTS BETTER . . . TOMORROW'S PRODUCTS POSSIBLE

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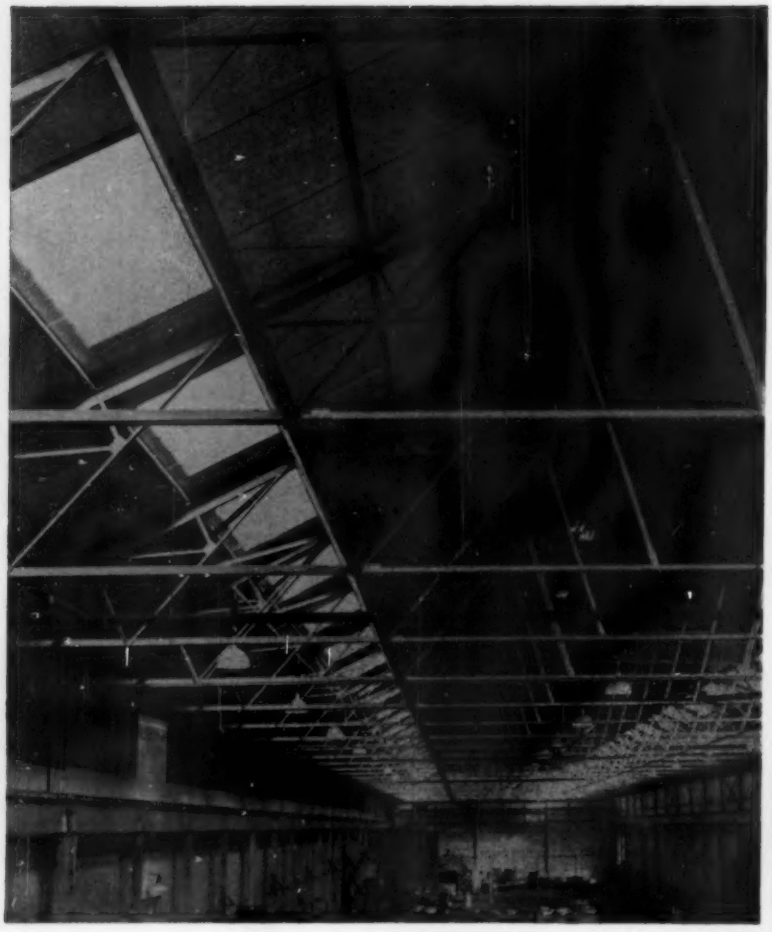


60,000 square feet of Hetron® gives Harvey Aluminum 25% more light plus a bonus in fire retardance

Cool natural daylight cascades down on the service areas of Harvey Aluminum's reduction plant at The Dalles, Oregon.

It comes through translucent fiberglass-reinforced polyester (Hetron) panels installed in continuous bands in the roof and walls.

Says Herbert Harvey, president of the primary aluminum producer:

"We needed a building material that would provide a maximum of natural daylight and would nest perfectly with our corrugated aluminum siding and roofing for a weather-tight seal. After conducting endurance tests, we specified the panels made by Filon Plastics Corporation. They're weatherproof and shatterproof. They provide diffused, glarefree daylight for all working areas."

**Fire retardance, too.** Hetron won't support combustion. These stronger, safer panels carry both Underwriters' and Factory Mutual seals of approval. You can specify them with confidence. Just write "Hetron-based" on the spec sheet.

If you'd like names and addresses of fabricators who can supply them, drop us a line.

DUREZ PLASTICS DIVISION
3911 WALCK ROAD, NORTH TONAWANDA, N. Y.
HOOKER CHEMICAL CORPORATION
HOOKER CHEMICALS PLASTICS

For more facts circle 543 on Reply Card

# OPERATION—PRODUCTION

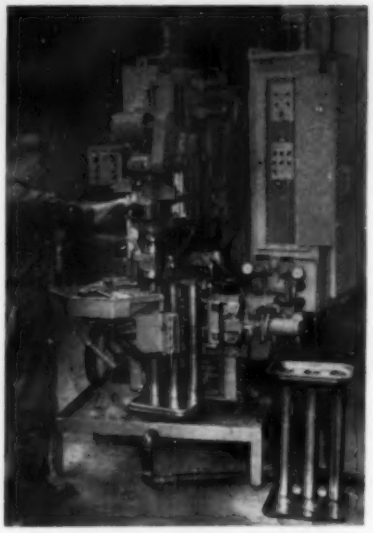
(O and P begins on page 56)

changers and 12,500-volt switchgear will be installed on the enclosed second floor. The cell line control panels will be on the third floor.

When activated, the system will have the capacity to feed 120,000 amperes at 203 volts d-c to the cell line. The large blocks of d-c power will be fed from four units, each consisting of four 7500-amp silicon rectifier sections, one power transformer and one voltage regulator. Space was also provided for the inclusion of a fifth unit which would bring the total amperage up to 150,000 when future demands call for it.

## Wobble Welder Solves Problem

SUPPOSE you were making a heat exchanger and wanted to weld three inch diameter 20 gage tubing to end panels of the same material. Each

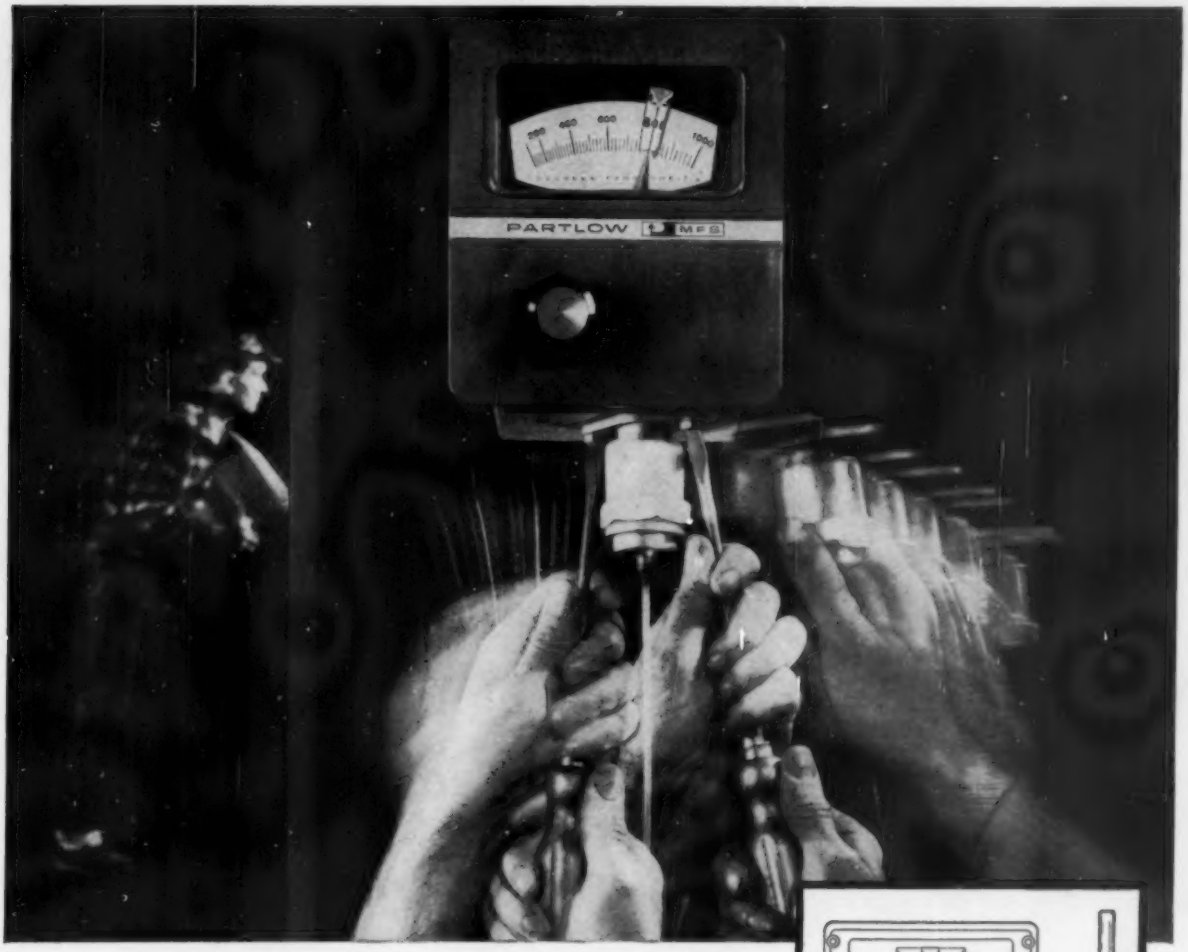


**Wobble head welder uses eccentric to rock cup electrode around weld.**

exchanger would require six circular welds.

This was the predicament Motor Wheel Corporation, Lansing, Michigan, found itself in with the heat exchanger required for its oil or gas fired mobile home furnace. A circular seam welder with a wheel electrode would not work as the tube diameter is too small. A ring projection welder with a fixed electrode would not work as the tube is too big.

Motor Wheel finally found the




*The Temperature Control Designed for Fast*

## "DO IT YOURSELF" MAINTENANCE

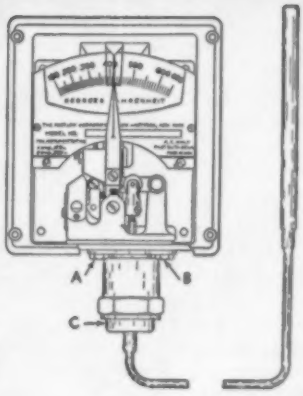
*Right on the Job!*

Rugged simplicity of design—along with the direct, positive power of mercury-actuation — combine to give Partlow maintenance and performance advantages no other type of temperature control can hope to equal.

Simplicity in the Partlow, for one thing, means that the control element can be changed *at the job site* in a matter of minutes with no other tool than a screwdriver . . . "Down time" is cut to an absolute minimum!

And simplicity in the Partlow also means the complete elimination of fussy electronic gadgets, delicate levers, hairsprings and other accessories that have a tendency to break down at the first trace of jar or jostle. Partlow controls are famous for their unfailingly accurate performance even under the most adverse operating conditions.

If you use or manufacture process equipment within the -30° to 1100° F. range, there's a Partlow pneumatic, electric or self-contained gas control (recording, indicating or non-indicating), to fit your application *precisely*. For details, write The Partlow Corp., New Hartford, New York. Dept. PE-1160.




*Diagrammatic view of the new MFS reveals "quick-change" feature common to all Partlow controls. In case of damage, merely unscrew at points (A) and (B), and remove element (C) from case. Reverse this process, and your Partlow is ready to resume operation.*

You can pay more but you can't buy better than

**PARTLOW**

**TEMPERATURE CONTROLS**

**For more facts circle 544 on Reply Card**

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# 20 tons

## OF OIL-SMOOTH PULLING POWER

## *NEW Snap-on* Hydraulic Puller saves downtime, cuts costs

The new SNAP-ON 20-ton hydraulic puller handles hundreds of pushing, pulling and pressing jobs quickly and safely. No more galled shafts — no more damaged parts through heating, prying or hammering. Even the tightest pressed fits are off with a few easy strokes of the handle — downtime can be cut from hours to minutes.

Hydraulic ram is threaded near the top for attachment of various yokes and adaptors for different jobs. Ram and adaptor can be used on the outside of a puller yoke. This is an exclusive feature and provides 6-in. longer reach than competitive units.

Another important feature is the accumulator sack on the pump. It permits operating pump in any position, eliminates back pressure and keeps oil free from contamination.

Ram and pump assembly is available separately or with your choice of a wide range of pullers — combination 2- and 3-jaw yoke-type, bar-type, and floor press, together with wide assortment of adaptors. Many of the SNAP-ON pullers you now have can be used with this hydraulic set. Get full details from your SNAP-ON representative or write for new literature.

*FOR ALL INDUSTRY*

**SNAP-ON TOOLS**

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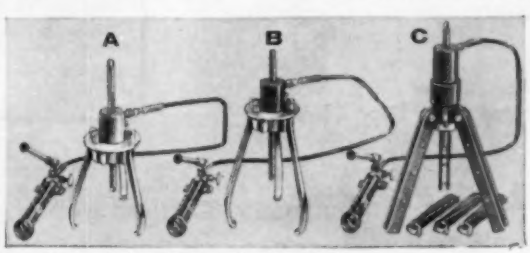



**SNAP-ON CG-420 ram and pump assembly shown with A, the CG-400 puller with 9½-in. reach and 13-in. spread; B, the CG-405 puller with 14-in. reach and 15-in. spread; C, the CG-425 heavy-duty puller with 19-in. reach and 20-in. spread.**

**For more facts circle 545 on Reply Card**


# OPERATION—PRODUCTION

(O and P begins on page 56)

answer in a welder equipped with a wobble head. The unusual welding head, built by Precision Welder and Flexopress Corp., is shaped like a cup. An eccentric drive rocks the cup electrode around the periphery of the weld, rotating it on edge with a rolling motion. The resulting weld is fast, clean and gas tight.

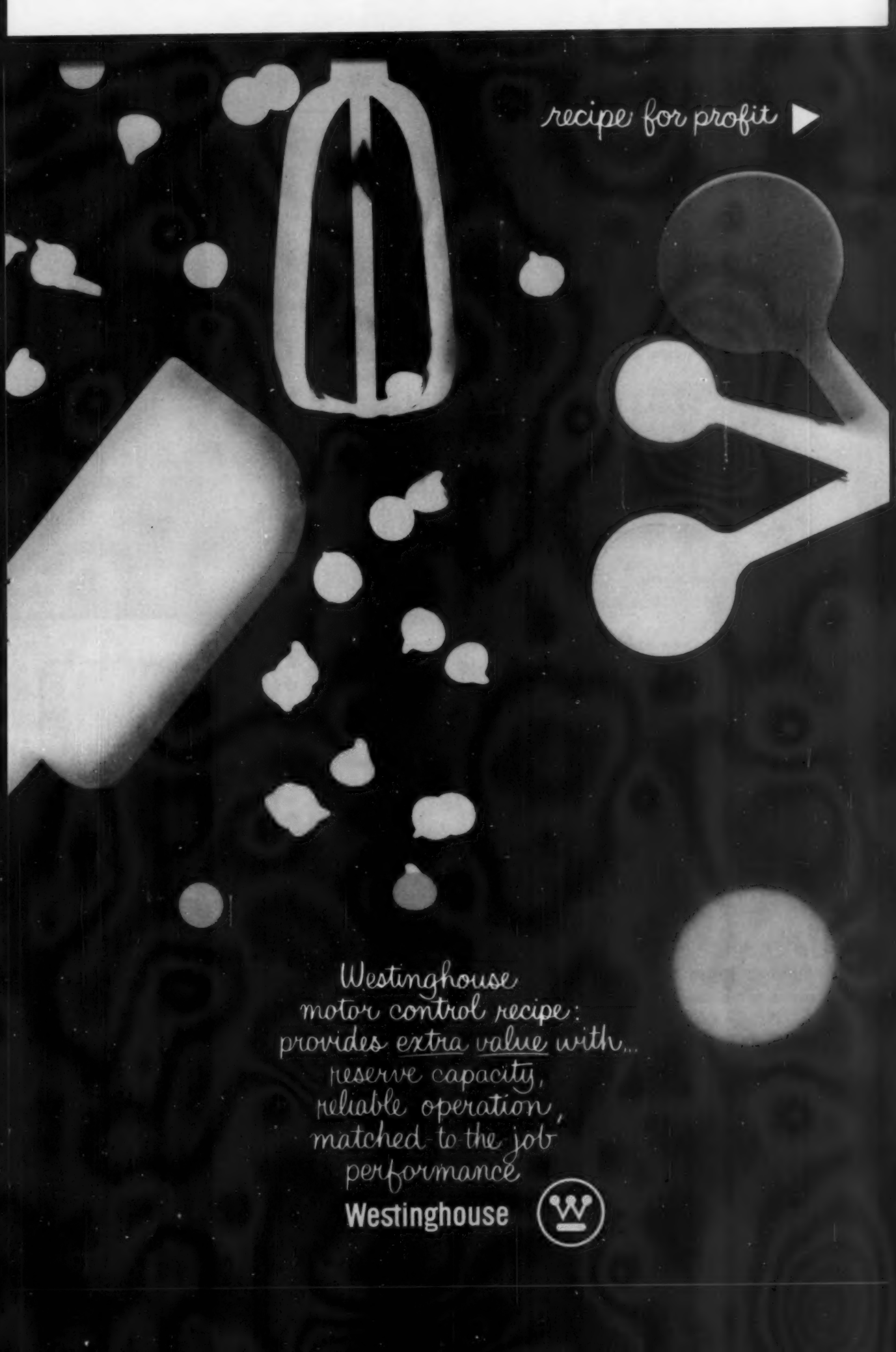
## Electric Heat Controls Asphalt

ELECTRIC resistance heaters keep asphalt at controlled temperatures in a fully automatic asphalt plant recently completed by Sicilian Asphalt Paving Company, Brooklyn, New York. In this completely automatic operation, the control room operator selects materials to be blended and initiates the operating sequence. Ten minutes later, waiting trucks are loaded with the exact tonnage.

All feed lines, pumps and tanks are equipped with heaters, engineered and manufactured by Hynes Electric Heating Company, to keep the asphalt at controlled temperatures. A manually preset thermostat controls temperatures in the tanks and internally traced pipe lines. During maximum demand hours, a time clock control cuts off the 442-kw heater load from the electric lines.

In the final mixing operations more than 1600 ft of asphalt pipeline are internally traced with heating elements drawing 163 kw. These lines are controlled to an accuracy of plus or minus five degrees Fahrenheit.

**Automatic operation of asphalt plant is dependent upon controlled heat.**


recipe for profit
Westinghouse
motor control recipe:
provides extra value with...
reserve capacity,
reliable operation,
matched to the job
performance
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TESTED RECIPES FOR PROFIT . . .

# Westinghouse blends "hidden" ingredients in extra value controls for profitable plant operations

- Quality control
- Design ability
- Quality components
- Application experience
- Manufacturing know-how
- Maintenance facilities
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How does Westinghouse handle this basic control recipe to make the result superior to any other? The best chef knows that the quality of the ingredients used and the mixing knack account for the blue-ribbon winners.

At Westinghouse, highest quality control components plus a large portion of expert manufacturing skill, craftsmanship and experienced know-how are carefully blended. Such "hidden" ingredients mean industrial motor controls with reserve capacity to handle overloads . . . long, trouble-free service . . . and performance custom-matched to your needs. Qualities that give **more control value for your money.** Qualities more than sufficient to meet today's demands for extraordinary reliability. That's why it pays to look beneath the surface of any control to be sure you are getting Westinghouse quality.

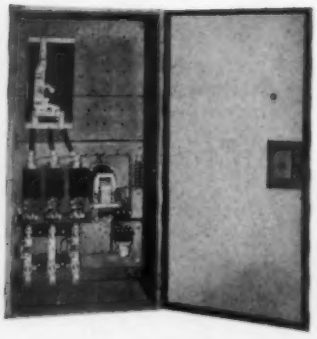
Your local Westinghouse representative is ready with a wide selection of industrial motor controls. Ask him to tell you more about their **hidden values** . . . benefits by the baker's dozen . . . for more profitable plant operations.

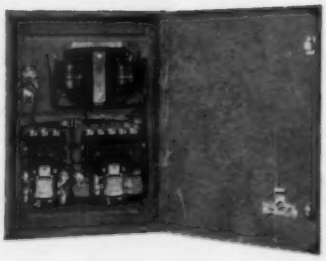
The proof of Westinghouse controls is in their using!

Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pennsylvania.

**Westinghouse**

Check your favorite chef's best dish. The recipe calls for the finest ingredients. However, real success comes from devoted attention to details. Superior product quality, likewise, requires premium components and craftsmanship.





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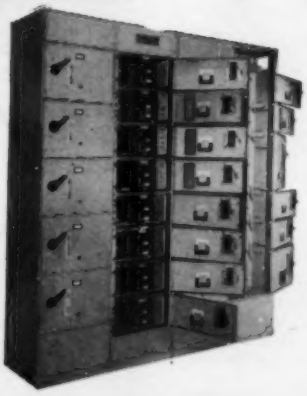


## Control Centers

Compact grouping of all motor controls
cuts installation time;
frees production areas;
permits easy one-man
control supervision;
speeds maintenance and service.

Interchangeable modular construction.

DESIGN TESTED AND VERIFIED in the Westinghouse HIGH-POWER LABORATORY

## Life-Line® Starters

Full-voltage, a-c magnetic starters in all NEMA enclosures.

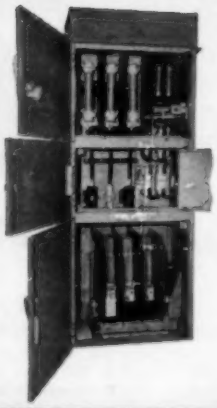
Time-tested components . . . straight-through wiring, front-accessible parts combine to slash installation and maintenance costs.

proved De-ion® arc quencher increases contact life . . .

silver plated interchangeable contacts . . . clapper-type operating mechanism . . . smaller compact designs.

Single phase or polyphase; up to 600 volts — reversing or non-reversing;

Non-combination or combination with disconnects or circuit breakers.



## Ampgard® High-Voltage Starters

Maximum protection for motors, systems and personnel.

Faults interrupted in less than ½ cycle . . . isolates fault to prevent shutdown of other equipment.

Completely front accessible.

Externally operated line isolating switch.

Exclusive mechanical and electrical interlock . . . prevents switch operation under load; automatically stops motor when cabinet is open.

Full line available . . .
for squirrel-cage, wound-rotor and synchronous motors up to 3000 hp — up to 5000 volts.

* Trade-Mark

## Reduced Voltage Starters

Widest possible selection of primary resistor, auto-transformer, part-winding and star-delta types for squirrel-cage, wound-rotor and synchronous motors in all hp ratings — up to 600 volts.

Manual and magnetic starters to provide the proper starting characteristics for any application.

Available with integral circuit breaker or disconnect switch — fused or non-fused.

Enclosures available for every need . . .
general purpose . . . dust-tight industrial . . .
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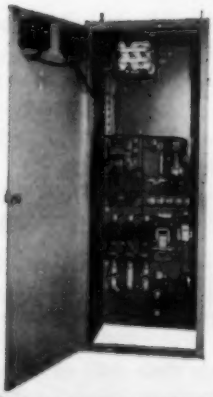
**Available for immediate delivery.**



## Static Slipsyn® Synchronous Motor Control

Static transistor circuit guarantees . . .
maximum reliability and accuracy;
no moving parts to wear, corrode or fail;
unaffected by contaminated atmosphere.

Motor field excitation applied at precise speed and pole position.

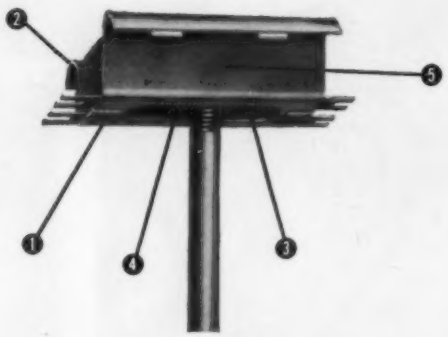
Adjustable pull-out protection, permits immediate detection or delays action to eliminate false tripping caused by transients.

Available as complete starter or field conversion unit for **any make** control!

J-25084-1

# See all the extra features you get in Grinnell Concrete Inserts...at no extra cost!

**GRINNELL WEDGE TYPE CONCRETE INSERT (Steel), FIG. 281 —** 1. Nut and rod may be preassembled for fast installation 2. Wedge-shaped body compresses in concrete for extra strength 3. Knockout (already removed) seals out concrete 4. Full 1¾ inch lateral adjustment 5. Supports up to 1200 lbs.



**GRINNELL LIGHT WEIGHT CONCRETE INSERT (Steel), FIG. 285 —** 1. Designed for light-duty use in concrete 2 inches and thicker 2. Arched flanges take reinforcing rods 3. Knockout seals out concrete 4. Full 2 inch lateral adjustment 5. Supports up to 400 lbs.

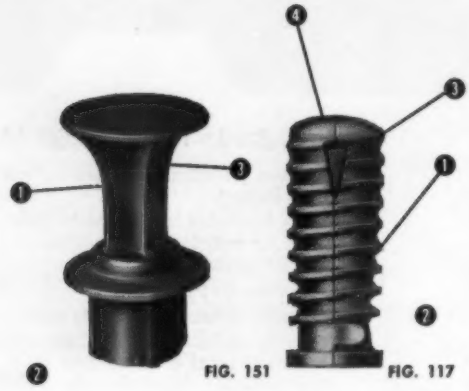
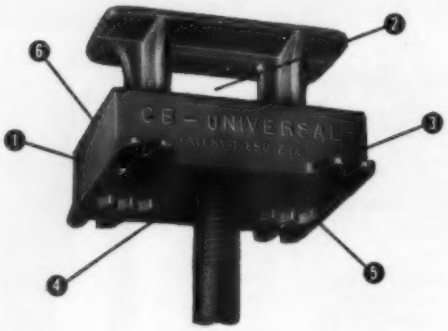


FIG. 151 FIG. 117

**GRINNELL SCREW CONCRETE INSERT (Malleable Iron), FIG. 151 — 1.** Malleable iron for extra strength 2. Pipe sizes through 12 inches. 3. Supports up to 2,120 lbs. **GRINNELL EXPANSION CASE (Malleable Iron), FIG. 117 — 1.** Malleable iron, cadmium plated, assures high resistance to impact, corrosion 2. Pipe sizes through 16 inches 3. Rod moving upward forces wedge-shaped nut downward, expanding and locking case in concrete 4. Supports up to 1300 lbs.




**GRINNELL CB "Closed Back" CONCRETE INSERT (Malleable Iron), FIG. 282 — 1.** One body size accommodates 5 sizes of rods 2. Slot takes reinforcing rods to assure maximum load rating. 3. One-piece body prevents concrete seepage 4. Teeth on insert and nut hold rod firmly in place 5. Homogeneous composition of malleable iron throughout 6. Supports up to 1430 lbs. (Also available in smaller "CB-JUNIOR" size that supports up to 770 lbs.)

You get *more* for your money from Grinnell, because Grinnell's huge volume reduces production costs . . . lowers prices right into line with competitive inserts offering much less.

Look at all you get with Grinnell Inserts: wider choices of types and sizes . . . better quality control . . . published ratings for *all* inserts! Faster delivery from nationwide warehouses, too. Moreover, you receive dependable field service by trained Grinnell personnel . . . no matter how far from the job site the sale was made! Grinnell Company, 277 West Exchange St., Providence 1, R. I. Branch warehouses in principal cities.

*Remember, The Best Costs No More — from America's #1 Supplier of Pipe Hangers and Supports*

**Call your local Grinnell Distributor for pipe hangers, cast and malleable iron fittings, steel nipples, welding fittings, Grinnell-Saunders Valves, unit heaters – all made by**

**GRINNELL**

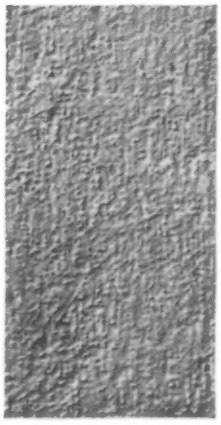
**For more facts circle 547 on Reply Card**

# A.W. ALGRIP abrasive flooring

Bits of food just naturally fall from barrels and open cartons onto the floor of this freezer at the warehouse of a nationally-known frozen food processor, but A. W. ALGRIP eliminates slipping and sliding . . . helps prevent accidents.

A. W. ALGRIP rolled steel floor plate is produced by Alan Wood Steel Company under a patented process by which an abrasive—just like the kind used in grinding wheels—is embedded to a controlled depth. It becomes an integral part of a tough steel plate.

A. W. ALGRIP can be used as independent flooring . . . or as flooring overlay, on level or inclined surfaces. Put your plant on a safe footing, with A. W. ALGRIP . . . Approved for Safety by Underwriters' Laboratories. Write for Bulletin AL-S4.



## ALAN WOOD STEEL COMPANY

**Conshohocken, Pa. • STEEL PRODUCERS WITH THE CUSTOMER IN MIND**

DISTRICT OFFICES AND REPRESENTATIVES: Philadelphia • New York • Los Angeles • Boston • Atlanta Cincinnati • Cleveland • Detroit • Houston • Pittsburgh • Richmond • St. Paul • San Francisco • Seattle Montreal, Toronto and Vancouver, Canada—A. C. Leslie & Co. Ltd.

**For more facts circle 548 on Reply Card**

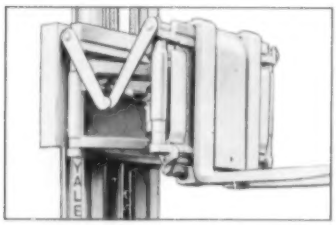


**For more facts circle 549 on Reply Card →**

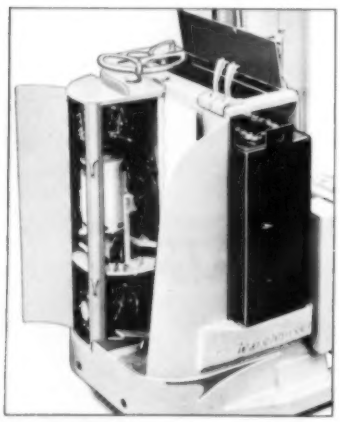
# save space
# you can't afford to waste

# YALE WAREHOUSERS

Control grouping saves time by permitting operator to lift or lower while travelling. Direction indicator in steering wheel hub shows drive wheel direction, saves effort in cramped quarters, prevents stalling. Hour meter checks operating time, ton-hour handling costs, permits maintenance based on running time.



An exclusive separate motor and hydraulic system in the Extend-A-Load for fork extension and tilt increases efficiency . . . saving power. Unitized design gives maximum maintenance accessibility. Exclusive, interlocking I-beam mast gives greater strength and stability. Mast and carriage ride on large ball-bearing rollers.



Operational maintenance is easier. Maximum accessibility to components without sacrifice of chassis strength and rigidity. Immediate access to battery for inspection. Easy battery removal.

**• Get more pallet rows in the same space • Can work in a 6 ft. aisle • Stack to 20 feet and more • Save on low maintenance • Reduce power costs • 2000, 3000, 4000 lb. capacity.**

You get greater power in less space with the 24-volt Yale Warehouser. More efficient use of power for increased work capacity. Faster lift and sustained high-speed travel.

The Yale Extend-A-Load model handles various widths of loads because different size pallets and skid bins can be handled without nesting between outriggers. Maintenance is easier and power is conserved by Yale's exclusive separate power unit for fork extension. Extend-retract device designed for low overall height to prevent robbing you of valuable space in high stacking. Forks can be tilted back to 6 degrees to protect load and speed operations. They can be extended, retracted or tilted at any height of lift. Twin tilt cylinders eliminate sway of forks—provide load stability.

**Start saving now. Yale has a finance plan that will put this truck to work for you immediately. For more information, contact your Yale Representative, or write to: The Yale & Towne Manufacturing Company, Materials Handling Division, Philadelphia 15, Pa. Dept. R-005.**

**Yale Materials Handling Division, a division of The Yale & Towne Manufacturing Company. Manufacturing Plants: Philadelphia, Pa., Forrest City, Ark. Products: Gasoline, Electric, Diesel, and LP-Gas Industrial Lift Trucks • Worksavers • Warehousers • Hand Trucks • Industrial Tractor Shovels • Hand, Air, and Electric Hoists**

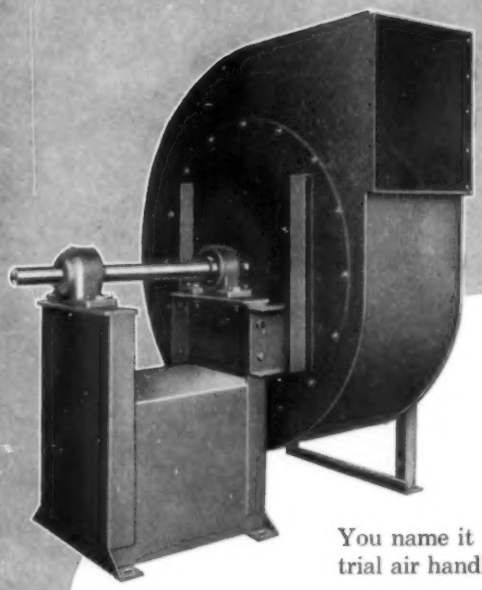
YALE

INDUSTRIAL LIFT TRUCKS
TRACTOR SHOVELS · HOISTS

YALE & TOWNE

Save space where space costs most—cold storage operations. How much does your space cost?

# How does industry rate CLARAGE?



**EXAMPLE:**
**Over 1000 Clarage fans of this type are serving one manufacturer alone.**

***RE-ORDERS . . . RE-ORDERS . . . RE-ORDERS***

You name it . . . Clarage has it for virtually any industrial air handling assignment.

Take the Type XL Fan shown. It's built in 16 sizes and four arrangements for volumes to 130,000 CFM, temperatures to 1000°F., pressures to 18". AMCA Certified Rating Seal applies to the three different wheels available —open, rim, and backplate types.

In the Clarage tradition of heavier duty construction, here is *quality* equipment assuring better results over a longer period of service. No wonder all 100 of America's 100 largest industrial corporations are Clarage users. If you too are after air handling and conditioning equipment that has what it takes—in every respect—contact our nearest sales engineering office.

*Dependable equipment for making air your servant*

**CLARAGE FAN COMPANY**

*Kalamazoo, Michigan*

SALES ENGINEERING OFFICES IN ALL PRINCIPAL CITIES • IN CANADA: Canada Fans, Ltd., 4285 Richelieu St., Montreal

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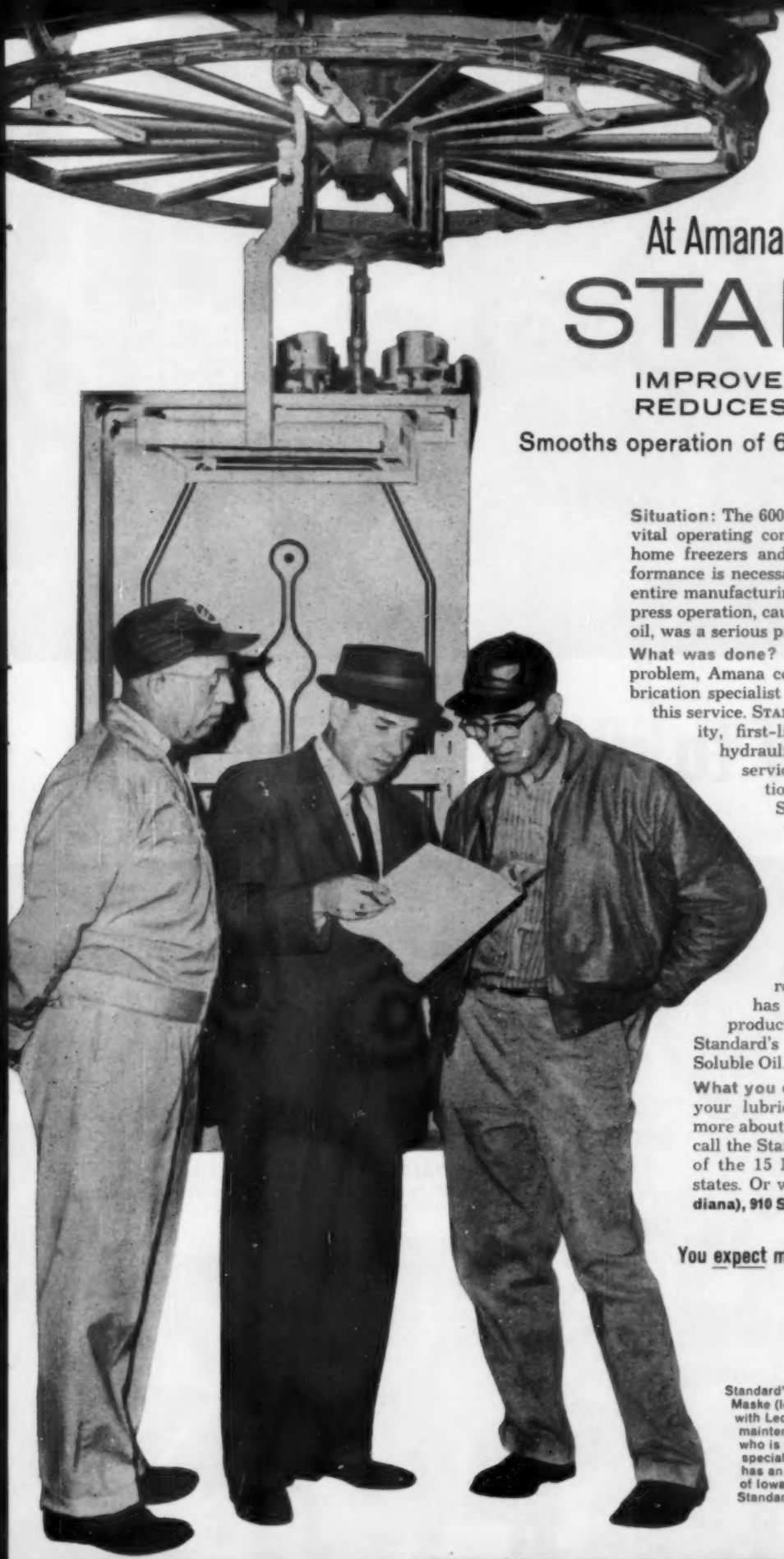
For more facts circle 551 on Reply Card→



# At Amana Refrigeration, Inc.

# STANOIL

## IMPROVES PRODUCTION
## REDUCES MAINTENANCE

### Smooths operation of 600 ton hydraulic press

**Situation:** The 600 ton Verson Press at Amana is a vital operating component in the manufacture of home freezers and refrigerators. Its proper performance is necessary to the efficiency of Amana's entire manufacturing operation. That's why erratic press operation, caused by foaming of the hydraulic oil, was a serious problem.

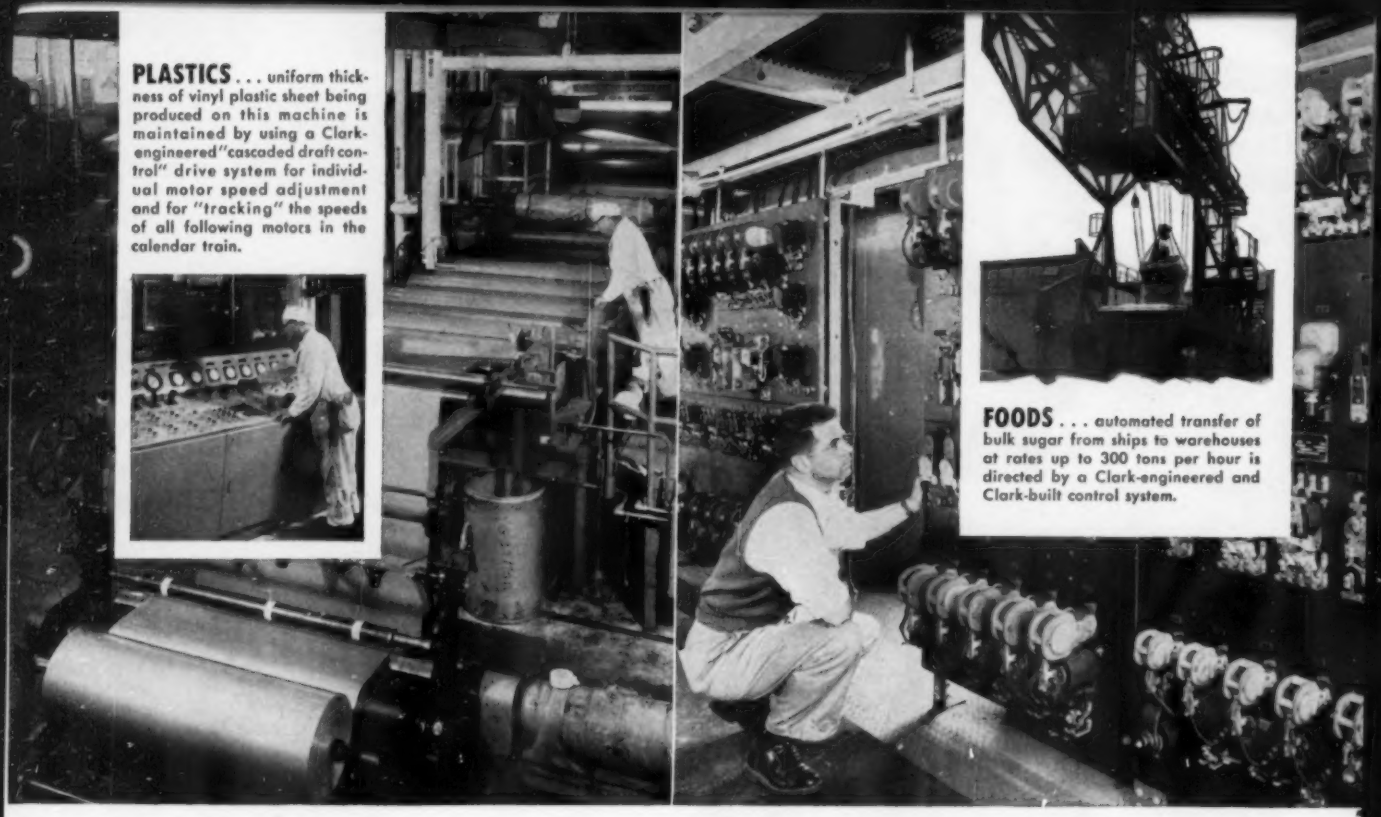
**What was done?** In seeking the solution to this problem, Amana consulted their Standard Oil lubrication specialist who recommended STANOIL for this service. STANOIL Industrial Oil is a top quality, first-line industrial lubricating and hydraulic oil. It will provide excellent service in many different applications. And when tested by Amana, STANOIL proved perfect for use.

**What has happened?** Since STANOIL was first put to work at Amana, it has performed for extended periods of time without foaming or oxidation, lengthening the time between drainings and improving press operation. As a result of this record, STANOIL has been adopted for use on other production equipment, together with Standard's RYKON Greases and SUPERLA Soluble Oil.

**What you can do:** To get help in solving your lubrication problems and to learn more about STANOIL Industrial Oils, simply call the Standard Oil office near you in any of the 15 Midwest or Rocky Mountain states. Or write **Standard Oil Company (Indiana), 910 S. Michigan Ave., Chicago 80, Ill.**

**You expect more from STANDARD and you get it!**

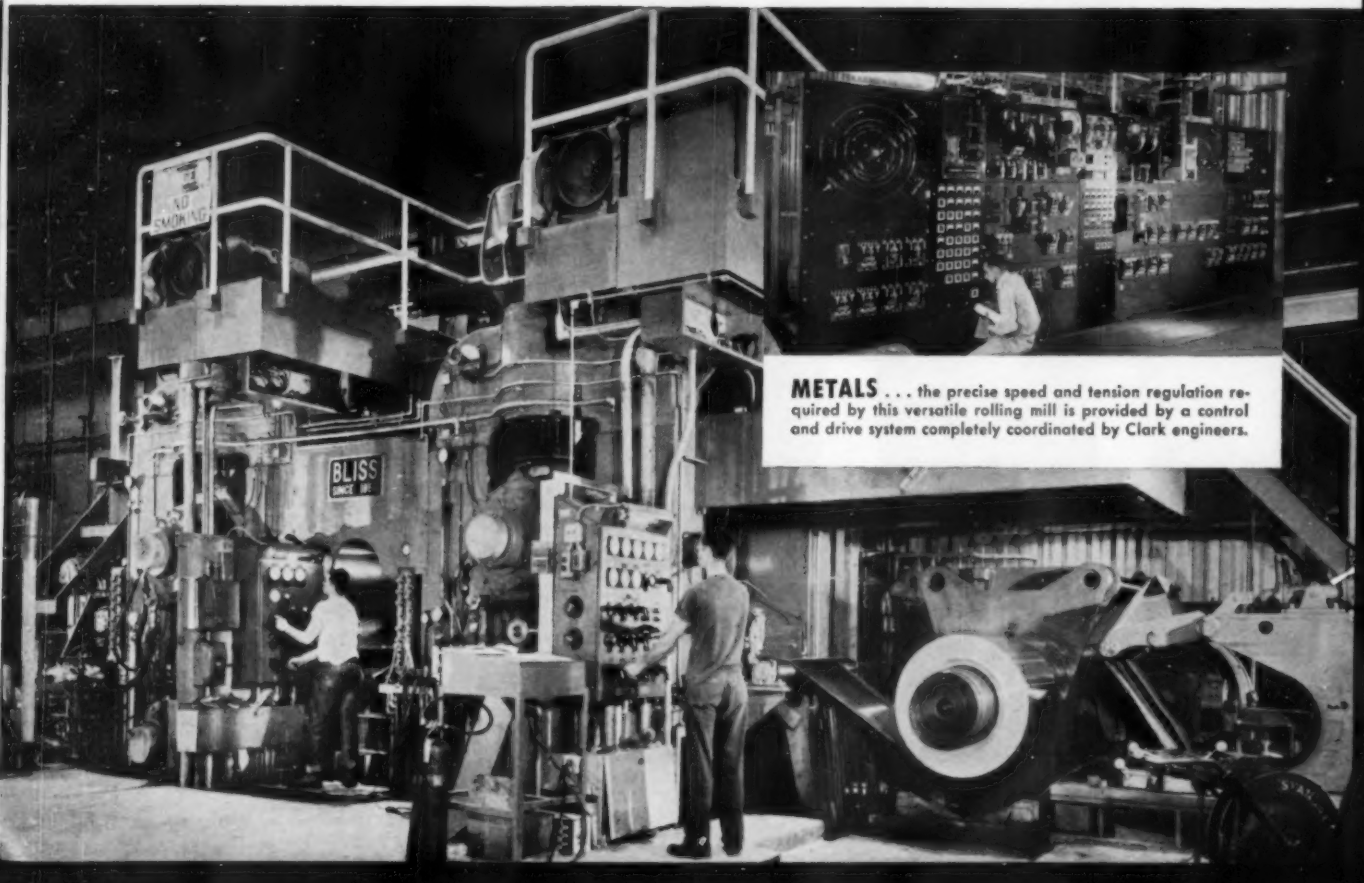
Standard's Jess Nelson (center) and Gene Maske (left) checking lubrication survey with Leonard Rettig, Amana's plant maintenance superintendent. Jess, who is District Engineer for Standard, is a specialist in this kind of operation. He has an engineering degree from the University of Iowa, and has also graduated from the Standard Oil Sales Engineering School.



**PLASTICS** . . . uniform thickness of vinyl plastic sheet being produced on this machine is maintained by using a Clark-engineered "cascaded draft control" drive system for individual motor speed adjustment and for "tracking" the speeds of all following motors in the calendar train.

**FOODS** . . . automated transfer of bulk sugar from ships to warehouses at rates up to 300 tons per hour is directed by a Clark-engineered and Clark-built control system.

# How to get the most from




**METALS** . . . the precise speed and tension regulation required by this versatile rolling mill is provided by a control and drive system completely coordinated by Clark engineers.

**AUTOMOTIVE** . . . to speed up auto body production and reduce idle time on three body conveyor lines, a complete control system with step-type speed selection was developed and supplied by Clark Controller.

# your machines and processes

Automatic control is the most vital element in today's automated processes, systems and machines.

Clark engineers are specialists in automatic controls, and Clark's control equipment—relays, contactors, push buttons, control centers, etc.—is designed with a thorough knowledge of specific industry requirements.

Clark is therefore ideally qualified to furnish complete coordinated control and drive systems.

Perhaps this great combination of product and experience can help you directly. It makes no difference what industry or type of production machinery or process. More and more automation-minded manufacturers everywhere are turning to Clark for completely coordinated control engineering service and equipment.

From concept to start-up, Clark engineers work as partners with engineering and manufacturing personnel, consulting engineers, contractors, and equipment manufacturers. We welcome the opportunity to show you how they can work for your particular advantage. For more information, contact your nearest Clark Controller sales office. Or, write direct.

60 A1

*The*
**CLARK CONTROLLER**
*Company*

*"Everything Under Control"*

**Main Plant:** *Cleveland 10* • **Western Plant:** *Los Angeles 58*
**In Canada:** *Canadian Controllers, Limited, Toronto*

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He might be in the maintenance office, next door . . . in the tool room at the other end of the factory . . . outdoors, getting into his car—now you can contact him instantly, privately.

The transmitter of the PAGEMASTER® Wireless Paging System sends coded tone signals by short-wave radio . . . received only by the pocket-size transistorized receiver of the one person you wish to reach. The signal repeats every 20 seconds until he answers the call.

Sending the signal is just as convenient. The compact ENCODER of the PAGEMASTER® system will accommodate 455 selective receivers and can page up to 4 people simultaneously. Add any number of extensions at a later date.

In addition to utmost speed, efficiency and flexibility, PAGEMASTER® offers very substantial economic advantages. It is obsolescence proof. Initial installation costs are low because you buy only what you require and add as need arises. There are no costly cable, speaker or light installations. The simplicity of the PAGEMASTER® Selective Wireless Paging System assures you minimum maintenance and lowest possible operator-time costs. For full information and literature, write to:

Commercial Products Division
1415-11 North Goodman Street
Rochester 3, New York

PAGEMASTER®
SELECTIVE WIRELESS PAGING SYSTEM

Remember . . . your Stromberg-Carlson Communications Consultant is only a local phone call away from you. He will be glad to analyze your communications problem and give you every possible help without obligation.

**STROMBERG-CARLSON**
A DIVISION OF **GENERAL DYNAMICS**

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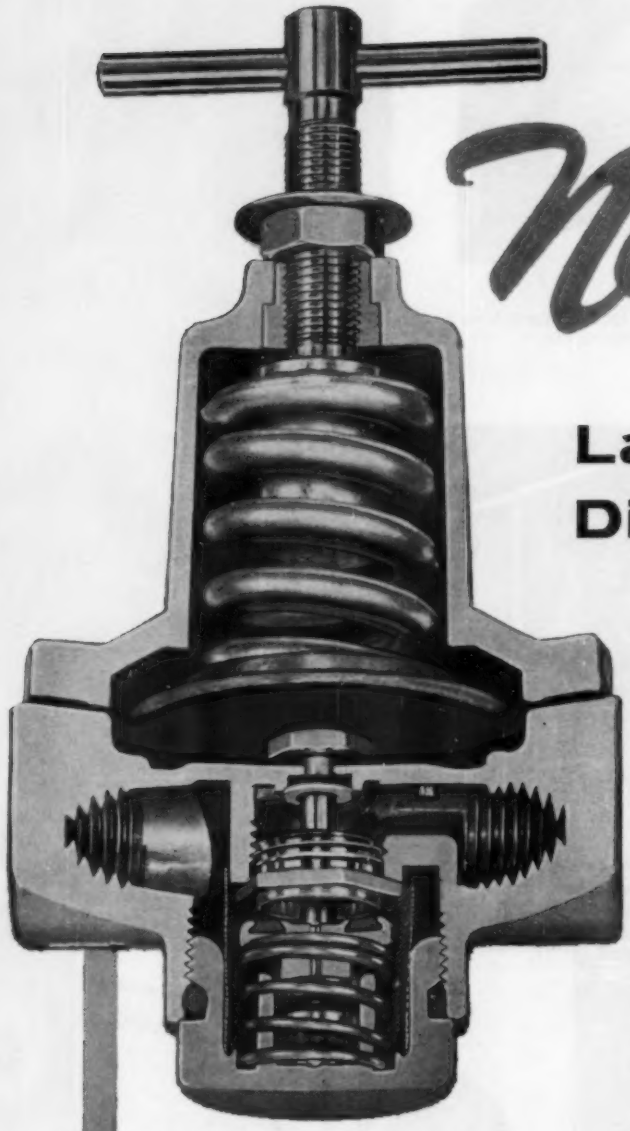
*All Pressure Regulators are not alike!*



# Norgren

## Large effective Diaphragm area

*provides closer pressure regulation*

The extra-large effective diaphragm area in Norgren Pressure Regulators provides maximum sensitivity to fluctuating operating conditions.

***Any slight deviation*** in regulated pressure, either as a result of fluctuating line pressure or varying flow demand, results in a greater total change in the force exerted by the diaphragm against the regulating spring. The valve immediately provides compensating action. This makes possible a highly uniform regulated pressure.

***Regulator performance is better*** because a more stable regulated pressure is maintained over a wide range of operating circumstances.

***The Norgren diaphragm*** is made of nylon-reinforced Buna N synthetic rubber, a combination that provides extra-long service, resulting in longer regulator life, more dependable operation and minimum maintenance.

***Norgren Pressure Regulators give you these important features:***

Balanced Valve Construction—improved regulator performance

Large Nylon-reinforced Buna N Synthetic Rubber Diaphragm—long service life

Baffle and Siphon Tube—increased accuracy

Large Passages and Valve Openings—large flow capacity

Easy servicing while still on air line

Flexible Valve Pin—assures better seating

**For complete information on all your regulator needs, ⅛" to 2", call your nearby Norgren Representative listed in your telephone directory—or WRITE FACTORY FOR DESCRIPTIVE LITERATURE.**

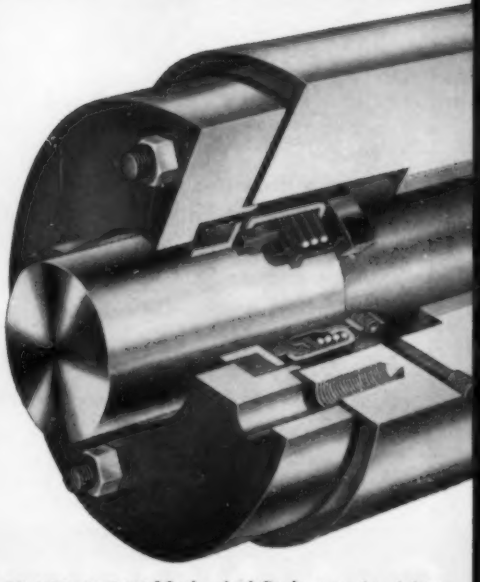
**C. A. NORGREN CO.** FOUNDED IN 1926

**3443 SOUTH ELATI STREET • ENGLEWOOD, COLORADO**

**For more facts circle 554 on Reply Card**

**CHEVRON** Packings can be applied against water, steam, oil, gases and chemicals to 600°F.

**LATTICE-BRAID** Packings are used to 700°F in water, steam, oil, gasoline, inert gases, acids, caustics, other chemicals.



**PK MECHANIPAK** Mechanical Seals operate at temperatures to 212°F, pressures to 150 p.s.i. in water, oil, alcohol, mild acids and solvents.

## ENGINEERED PRODUCTS

for Plant Maintenance

**A greater number of utilities and industrials are standardizing on Garlock for low-maintenance, leak-free sealing throughout the plant.**

**For rams, plungers, and reciprocating rods,** Garlock CHEVRON* Packings offer positive, low friction service. With an exclusive hinge-like construction, CHEVRON packing rings tighten to prevent leakage as pressures increase. When pressures decline, the rings ease off to permit free operation of the rod, ram, or piston without leakage. CHEVRON packing rings provide adequate heel clearance for easy installation. Once installed, further gland adjustment is rarely, if ever, necessary. Catalog AD-104.

**For rotary and centrifugal shafts, valve stems, and reciprocating rods, rams, and plungers,** Garlock LATTICE-BRAID* Packings are engineered for longer packing life. They employ a through-and-through braiding construction. As illustrated, each strand passes diagonally through the packing at a 45° angle. This unique construction makes a completely unified structure, resulting in greater strength. Since there is no single outer braid to wear through, Garlock LATTICE-BRAID wears far beyond the limits of ordinary packings. Catalog AD-131.

**For rotary shafts,** Garlock PK MECHANIPAK Mechanical Seals are easy to install and maintain. They are completely self-contained . . . no parts to put together. Rotating portion simply slides onto shaft; stationary portion positions quickly. Once installed, further adjustment is unnecessary. No parts of the seal move on the shaft or sleeve, eliminating wear on the shaft. Available in shaft sizes from $\frac{3}{8}$" to 3" for shaft speeds up to 2000 f.p.m. and higher. Catalog AD-150.

**Take advantage** of Garlock's years of experience with sealing problems of all types. Call your local Garlock representative at the nearest of Garlock's 26 sales offices and warehouses throughout the U.S. and Canada. Or, write for the catalogs indicated.

# GARLOCK

Garlock Inc., Palmyra, New York

**Canadian Div.:** Garlock of Canada Ltd.

**Plastics Div.:** United States Gasket Company

**Order from the Garlock 2,000** . . . two thousand different styles of Packings, Gaskets, Seals, Molded and Extruded Rubber, Plastics Products

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# WANT TO SAVE SOME MONEY?

I-T-E URELITE individually enclosed large air circuit breakers. Available up to 600 v a-c, 15-4000 amp continuous, up to 150,000 amp interrupting.

## SAVE INSTALLATION EXPENSE

Look at that roomy cable box. I-T-E URELITE® gives plenty of elbow room to the men who install it. Easy to pull and connect even extra-large conductors. You can bring them in from either the top or bottom. This design means fast, easy, low-cost installation.

## SAVE MONEY WHEN YOUR LOAD GROWS

Want to increase the current rating of your URELITE breaker? Just reset the trip devices. It takes only minutes. Expanded ranges eliminate shutting down the circuit and replacing devices. Calibration is directly in amperes for easy, accurate setting.

Send for new illustrated Bulletin 4261-2b. I-T-E Circuit Breaker Company, Dept. SW., 1900 Hamilton St., Philadelphia 30, Pa.

**I-T-E CIRCUIT BREAKER COMPANY**

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MADE IN U.S.A.
EDWIN L. WIEGAND CO
PITTSBURGH, PA.
CHROMALOX
CHROMALOX
FIRST NAME IN ELECTRIC HEAT
Embossing press converted to electric heat.
Curved to match circumference of round pipe.
Mounted on side of dip tank.
Two heater groups, separately controlled for zoned heat.

# CHROMALOX

## ELECTRIC STRIP HEATERS

### QUICK, LOW-COST SOLUTION TO PRODUCTION HEATING PROBLEMS

For heating tanks, kettles, pipes, platens, dies, ovens . . . just about anything. Chromalox Electric Strip Heaters provide uniform heat to exact temperatures.

Heaters available in shapes, sizes and wattages to fit hundreds of industrial heating needs . . . including yours. Installation is quick and easy . . . using standard bolts or clamps. Heaters give long service with little or no maintenance. Temperatures are maintained by either manual or automatic controls.

Write for Bulletin PA100. Or, for fast action and on-the-job assistance with your heating problems, call your Chromalox Sales Engineering Representative listed below. 01004

**Call Your Chromalox Man for Heating Answers**

ALBANY N.Y.
Hobart 3-0626

ATLANTA GA.
Trinity 5-7244

BALA-CYNWYD PA.
Mohawk 4-6113
Greenwood 3-4477

BALTIMORE MD.
Hopkins 7-3280

BLOOMFIELD N.J.
Edison 8-6900
New York: Worth 4-2990

BOSTON, MASS.
Cedar 5-8040

BUFFALO, N.Y.
TT-6-4000

CHARLOTTE, N.C.
Edison 4-4244
Franklin 5-1044

CHATTANOOGA, TENN.
Amherst 5-3862

CHICAGO, ILL.
Harrison 7-5464

CINCINNATI, OHIO
Trinity 1-0605

CLEARWATER, FLA.
Phone 3-7706

CLEVELAND, OHIO
Prospect 1-7112

COLUMBUS, OHIO
Amherst 7-8260

DALLAS, TEX.
Riverside 8-9004

DAVENPORT, IOWA
Phone: 6-5233

DENVER, COLO.
Glendale 5-3651
Genesee 3-0821

DES MOINES, IOWA
Cherry 3-1203

DETROIT, MICH.
(See Southfield, Mich.)

HOUSTON, TEX.
Capitol 5-0356

INDIANAPOLIS, IND.
Melrose 5-5313

KANSAS CITY, MO.
Victor 2-3306

LOS ANGELES, CAL.
Ludlow 9-6321

MIDDLETOWN CONN.
Diamond 6-9606

MILWAUKEE, WIS.
Broadway 1-3021

MINNEAPOLIS, MINN.
Federal 6-6631

NASHVILLE, TENN.
Cypress 2-7016

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(See Bloomfield, N.J.)

OMAHA, NEB.
341-7600

PHILADELPHIA, PA.
(See Bala-Cynwyd, Pa.)

PITTSBURGH, PA.
Emerson 1-2900

PORTLAND, ORE.
Capitol 3-4197

RICHMOND, VA.
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Chestnut 1-2433

SAN FRANCISCO, CALIF.
Underhill 1-3000

SEATTLE, WASH.
Main 4-7297

SOUTHFIELD, MICH.
Kenwood 8-2100
Elgin 7-0677

SYRACUSE, N.Y.
Granite 4-3933

WICHITA, KAN.
Amherst 2-5647

**EDWIN L. WIEGAND COMPANY**
7500 Thomas Boulevard • Pittsburgh 8, Pa.
CHurchill 2-6400

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# Here's one cold line that will not sweat

Condensation on cold lines can be stopped—surely and economically—with Armstrong Armaflex 22 Pipe Covering. New improved Armaflex 22 is a flexible foamed plastic insulation with better vapor resistance, durability, and appearance—plus a wider temperature range than other insulations of this type.

New Armaflex 22 offers complete protection against water and water vapor. Applied in recommended thicknesses to any cold lines, it stops damaging condensation. No finish is needed on indoor installations. And you can be proud of the appearance of a job done with Armaflex 22. A new, super-smooth surface gives you a neater installation.

Armaflex 22 can be applied not only to all cold lines, but also to heated piping operating to 220° F. That means that on jobs where hot water, chilled water, refrigeration, and dual temperature lines are involved, this one insulation can be used throughout to simplify the installations.

The only tools needed to apply Armaflex 22 are a miter box, knife, brush, and can of Armstrong 520 Adhesive.

Complete information on Armaflex 22, explaining in detail why it is a superior insulation of its type, is contained in a new booklet. Write for your free copy today to Armstrong Cork Company, 2211 River Rd., Lancaster, Pa.

**Armstrong INSULATIONS**

*1860-1960 Beginning our second century of progress*

**For more facts circle 558 on Reply Card**

# COURT DECISIONS —a summary of legal findings of interest to the plant engineer

*Prepared by Albert Woodruff Gray*

## Safe Place to Work

EMPLOYED ON AN IOWA farm, a workman who had spent the greater portion of his life working as a truck driver, undertook the operation of a hammermill grinder.

Two or three other times he had operated this grinder safely. This time, however, he slipped, caught his sleeve on the power shaft and was pulled into the shaft and seriously injured.

In their defense, his employers maintained that the danger was so obvious that neither instructions nor warning were needed. In sustaining a judgment in favor of the victim of the accident, the court said:

"It is a rule of common law and of this court that the employer must use reasonable care to provide and maintain a reasonably safe place for employees to work and the same care is required to provide and maintain reasonably safe appliances, machinery and tools with which to work. Clearly there is substantial evidence that these employers were negligent in not furnishing the workman reasonably safe machinery." Court brief 99 N.W. 2d 287, Iowa, November 17, 1959.

## Final Payment

SUIT WAS BROUGHT in New York by a distributor to recover an unpaid balance which he contended was still owing for sales commissions. In its defense, the manufacturer showed a check payable to the distributor on which had been endorsed "Final payment."

The president of the manufacturer insisted this was in full settlement of any claim due or to become due. It was further insisted, by this man, that the endorsement had been written on the check before it had been signed by the president.

The court sent to the bank for a photostat of the check, as it had been when presented for payment. This photostat showed no endorsement of the words "Final payment."

In rendering judgment against the manufacturer, the court said that the sole evidence of this endorsement was based on the oral testimony of the president of the manufacturer. "His testimony that the endorsement had been thereon when he sent the check, and in the light of the check alteration after its return to his company, is rejected as totally untrustworthy." Court brief 187 N.Y.S. 2d 291, May 5, 1959.

## "Call" Contract

CONTRACT BETWEEN the United States and a lumber contractor in California, provided, in part, "The contractor shall furnish and supply to the Government, lumber storage services and special lumber millwork service in connection with Government-owned lumber delivered by the Government to the contractor's plant. The contractor shall furnish said services when and as the Government may make calls for, hereunder, during the period set forth."

In an action brought against the United States based on this contract, the government contended that this agreement was not a binding contract but only became such upon the issuance of a call pursuant to these contract provisions. In holding this contract and its provisions valid and binding on the government, the United States Court of Appeals said,

"Therefore, although the contract from its terms could be characterized as a 'call' type contract, it could not from its terms be classified as one in which the parties had eliminated all reasonable doubt of its also being a requirement type of contract.

"It is elementary that a contract in which one party has agreed to supply and the other party has agreed to take all of its requirements, if it has any requirements, for a specific period, has the necessary mutuality of obligation to form a valid and enforceable contract." Court brief 270 Fed. 2d 12, California, August 14, 1959.

## Crane Used as Scaffold

CONTRACT WAS made for painting the structural steel and windows of a Chicago steel plant. While standing on the drum of a crane, placed in position for the workman's use by the plant for a scaffold, a painter was thrown to the floor when the drum, through an accidental pull of the starting lever of the crane, began to revolve.

The appellate court sustained the judgment in favor of the painter against the steel company. It said of a statute in that state known as the Scaffold Act,

"The object to be attained by this statute was to prevent injuries to persons employed in these dangerous and extra hazardous occupations so that negligence on their part in the manner of doing their work might not prove fatal.

"No attempt is made to define what shall be considered or shall constitute a safe, suitable and proper scaffold which from the very nature of things, could not well be done, for what might be a safe, suitable and proper scaffold for one kind of work under one set of conditions or circumstances would be wholly inadequate, insufficient and unsafe for doing another kind of work under other conditions or circumstances and at a different height from the ground.

"Consequently the legislature has not attempted to define what shall constitute a safe, suitable and proper scaffold but has cast the burden of constructing safe, suitable and proper scaffolds upon the employer and he cannot escape liability for injuries sustained by reason of his failing to furnish such scaffolds by complete ignorance of other dangerous conditions when other conditions are known to him." Court brief 277 Fed. 2d 726, Illinois, April 21, 1960.

## Unenforceable Contract

SUIT WAS brought by an engineer for commissions claimed by him to be due under an oral employment contract.

The engineer was discharged by his employer at the end of 1955 and payment of his commissions for that year were refused. The employer contended that the contract was unenforceable and as a consequence no money was either due or owing.

By the Statute of Frauds it is provided that, "In the following case every agreement shall be void unless such agreement or some note or memorandum thereof expressing consideration, be in writing and subscribed by the party charged therewith: every agreement that by its terms is not to be performed within one year from the making thereof."

Awarding a judgment in favor of the engineer, the Wisconsin court said, "Payment for the services to be rendered by the employee is an essential part of an employment contract. Since the employee has fully performed the services under the contract the employer cannot successfully urge that its part of the agreement, i.e., payment of the commission, is void or falling within the ban of the Statute of Frauds." Court brief 103 N.W. 2d 31, Wisconsin, May 3, 1960.

## Carrier's Liability

ROLLED SHEET metal bundled into 10,000 lb lifts was shipped by railroad from Indiana Harbor, Indiana, to Two Rivers, Wisconsin. When the car was opened by the consignee rust had corroded each sheet of metal 1½ to 2 in. from the edge. It was admitted by the railroad that this rust was the natural result of water condensing on the steel from weather conditions encountered en route.

In the suit by the consignee against the railroad, the question to be answered, as formulated by the court, was, "Does the carrier have the burden of proving its freedom from concurring or contributing negligence when

# COURT DECISIONS

it has established that the damages to the shipper's goods resulted from the inherent vice or nature of the goods."

To this the court made the answer, "The rusting of the steel and resulting damage was due to the inherent nature of the steel, i.e., its natural tendency to rust from moisture caused by condensation due to temperature changes. On the facts disclosed it is apparent that the loss occurred solely by the operation of natural laws upon the steel. Where such is the case the carrier is not liable." Court brief *277* Fed. 2d 652, Wisconsin, May 4, 1960.

## Corporation Conspiracy

A MANUFACTURER of portable electric power tools, equipment and accessories was charged with conspiring with its own manager in violation of the Antitrust Act. Suit was dismissed by the United States Court with the comment,

"The corporation could not conspire with its own manager, acting within the scope of his authority." As authority for this statement of the law, reference was made by the court to the rule in an earlier decision in which a federal court had said, "It is basic in the law of conspiracy that we must have two persons or entities to have a conspiracy.

"Surely discussions among those engaged in the management, direction and control of a corporation concerning the price at which the corporation will sell its goods, the quantity it will produce, the type of customers or market to be serviced or the quality of goods to be produced, do not result in the corporation being engaged in a conspiracy in unlawful restraint of trade." Court brief 172 F.S. 221, New York, April 16, 1959.

## "Grandfather Clause"

ISSUANCE OF licenses for master electricians in Dade County, Florida, was subject to an ordinance of that county that every person who upon the effective date of the ordinance held a "current certificate of competency" should be entitled to a certificate without examination.

It was further provided, however, that, "Such certificate shall be subject to any restrictions and limitations carried by the current county certificate and shall entitle the holder of such certificate to do business only in the unincorporated areas unless the Examining Board concerned, upon presentation by the applicant of evidence satisfactory to such Board, shall determine that such certificate may be extended to include the incorporated areas of Dade County."

An occupational licensee in the trade for more than 10 years was denied a certificate by the Board. He appealed to the Florida court for an order that his certificate be issued. The order was granted with the comment on this ordinance by the court,

"It is clear that a licensing ordinance which allows a Board to issue or withhold a certificate of competency on certain specified proof at its whim and not according to any fixed or ascertainable standards, requirements or qualifications of the applicant, would not be valid.

"A licensing ordinance must prescribe definite rules and conditions for an applicant to meet and may not place power in the uncontrolled discretion of the Board." Court brief 120 So. 2d 625, Florida, May 9, 1960.

## Failure To Give Notice

SHIPMENT OF 177 pieces of 16 in. steel casing was received at Houston, Texas, on the *S.S. Adolph Vinner* from Antwerp, Belgium. The shipment was then transferred from the boat directly to railroad cars.

Straight bill of lading acknowledging that the shipment had been received in apparent good order was issued by the railroad. Upon arrival at Long Drive Team Track, in Houston, the steel casing was inspected and it was discovered that 115 of these 177 pieces were badly damaged. Written notice of the damage was next given both to the ship carrier and the railroad.

In absolving the ship carrier of liability, the court rested its decision on the U. S. Carriage of Goods by Sea Act, which is that, "Unless notice of loss or damage and the general nature of such loss or damage be given in writing to the carrier or his agent at the port of discharge before or at the time of the removal of the goods into the custody of the person entitled to delivery thereof under the contract of carriage, such removal shall be prima facie evidence of delivery of the carrier of the goods as described in the bill of lading."

Affirming a judgment in favor of the ship carrier, the Texas court said, "In this case the consignee failed to give written notice of the damage to the shipment in question to the ship carrier or its agent at the port of discharge before or at the time of the removal of the goods into the custody of the railroad and, indeed, did not give the required notice until approximately six days after the shipment had been delivered to carrier. Therefore, under COGSA, the ship carrier established its defense by the consignee's failure to give notice as required." Court brief 335 S.W. 2d 269, Texas, April 14, 1960.

## Confidential Information

CONTAINED IN an employment contract was the provision that the employee would not, after the termination of this employment, use to the advantage of himself or of any other person or organization any information gained by him verbally or from the files of the employer. And that this employee could not communicate such information to others.

Suit for damages was brought by the employer against this employee after the employment had terminated, for what the employer maintained was a breach of this clause of the agreement. The suit was dismissed by the court with the statement that a covenant of this character in an employment contract is not in and of itself invalid, (1) If the interest to be protected is consonant with public policy, and (2) If the restraint is reasonably limited in time and space.

Then in denying the employer the damages he sought, the court said, "An employer may prevent his employee, upon termination of his employment, from using for his own advantage or that of a rival and to the harm of his employer, confidential information gained by him during his employment, but he may not prevent the employee from using the skill and knowledge acquired or improved through his employment."

Then referring to this particular contractual provision, "It is broad enough to embrace matters which the employee ought not to be prevented from carrying away with him. It is not a policy of our law to enforce restraints of that sort especially when they are unlimited as to territory and time." Court brief 166 N.E. 2nd 729, Massachusetts, April 27, 1960.

## Employee or Contractor?

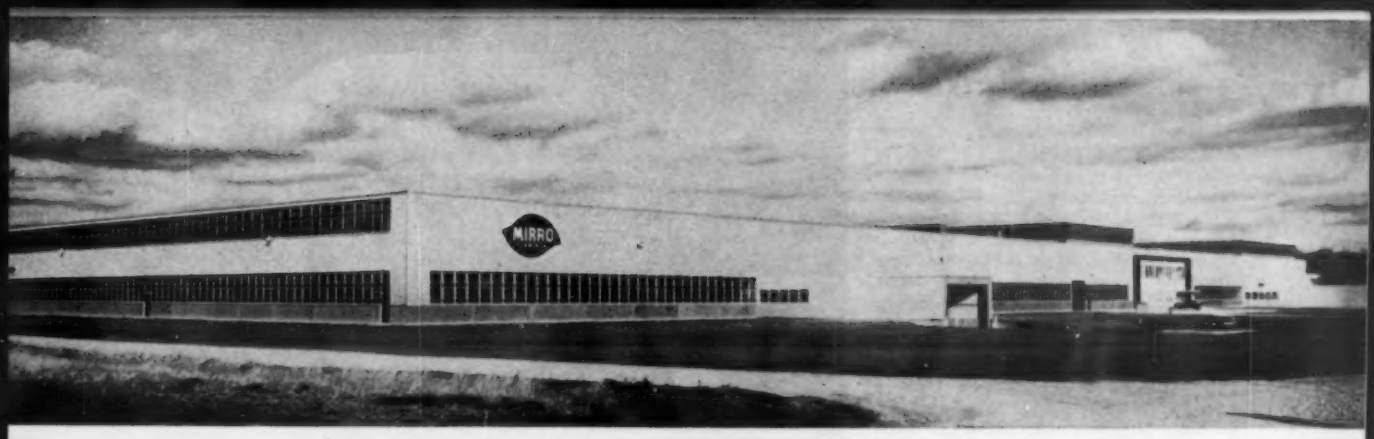
WHILE ENGAGED in the welding together of 18 barrels to be used as floats to support pipe, one of the barrels exploded, injuring the weldor.

The owner of the business contended, in its defense, that under the Workmen's Compensation Act this workman was not an employee of the owner but an independent contractor, and hence could not recover compensation as an employee.

The relationship between the owner of this business and the workman had commenced with a telephone call to come over and do some welding. For the work the weldor was to receive $4.00 an hour.

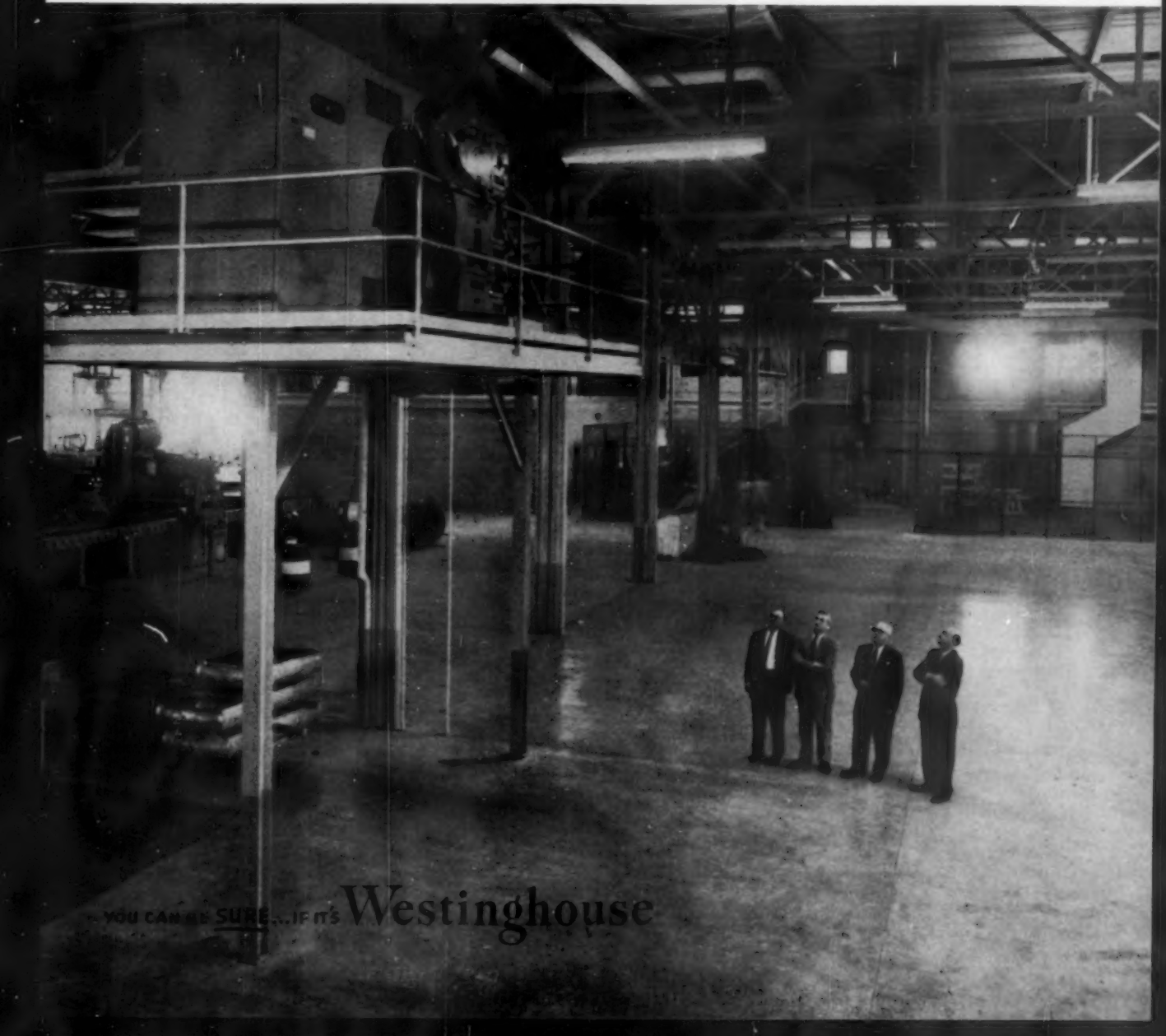
Asked if he could have stopped the work on the barrels at any time he wanted and have paid the weldor, the owner had answered "yes."

By the Georgia court it was held that the weldor was not an independent contractor but an employee entitled to the protection of the compensation law. "Where one is employed generally to perform certain services for another and there is not a specific contract to do a certain piece of work according to specifications for a stipulated sum, it is inferable that the employer has retained the right to control the manner, method and means of performance of the contract and that the employee is not an independent contractor." Court brief 114 S.E. 2d 57, Georgia, March 18, 1960.




# New Mirro Aluminum plant can double production without changing electrical system

J-94147-1



YOU CAN BE SURE...IF IT'S Westinghouse

PRECEDING PAGE

At top, Mirro Aluminum's handsome new rolling mill at Manitowoc, Wis., is appropriately sheathed in maintenance-free aluminum siding.

At bottom, men who helped Power-Up the new mill inspect a Westinghouse 1000-kva Type ASL ventilated dry-type power center which feeds power to productive equipment. Space has been provided in power center for additional drawout Type DB feeder breakers when needed. On power center platform: W. E. Reimer, Uihlein Electric Co.; J. R. Miller, Westinghouse Construction Engineer; and V. E. Mulvaney, Westinghouse Sales Engineer. Standing below: Roy Angrick, Chief Construction Engineer, Klug & Smith Co.; Edwin Zagrodnik, Mirro Rolling Mill Superintendent; M. E. Hutchins, Mirro Project Engineer and Metallurgist; and H. E. Toll, District A&S Manager, Westinghouse Electric Supply Co.

AT RIGHT

In coil slitting area, a 45-kva DT-3-B dry-type transformer with attached primary circuit breaker is mounted at the load to provide 120/208-volt power for lighting. Maintenance-free, lightweight Westinghouse transformers are easily mounted off the floor. On side of control cabinet: a 225-amp, J-frame Westinghouse AB-I circuit breaker which protects control unit. Talking over plant's electrical system: J. R. Miller, H. E. Toll, Roy Angrick and W. E. Reimer.

J-94147-2

Imposing line-up of 5-kv indoor metal-clad switchgear with Type DH drawout air circuit breakers. Used for control of mill's synchronous and induction motors, they are also used to protect feeder circuits to power centers throughout the plant. (At left) Low-voltage drawout switchgear end of a 1000-kva power center. Messrs. H. E. Toll, W. E. Reimer and M. E. Hutchins inspect 50-DH-250 main breaker compartment.

# Westinghouse power system planned for today's . . . and tomorrow's production

The progressive Mirro Aluminum Company has taken a big step forward in its long-range expansion program. Recently completed: a heavy-duty, fully integrated aluminum rolling mill at Manitowoc, Wis., covering 238,818 square feet. Present annual capacity: 60 million pounds of aluminum for use in cookware, electric housewares, boats, foil, toys, and component parts for industry. Anticipating Mirro's production goals and planned product diversification, plant output can be doubled . . . *with no major alterations in the plant's electrical system.*

Westinghouse, working closely with Mirro representatives, the consulting engineer and electrical contractor, participates in the design of a plant system that's adequate for today, ready for tomorrow. Standard Westinghouse apparatus, capable of meeting the stringent requirements of process equipment, was specified for the primary distribution system. Eliminated was the need for expensive, specially engineered or custom-built apparatus.

The planning team found that a simple, modified, modern radial distribution system using 5-kv Type DH breakers feeding individual power centers at main points of load would best serve the plant. Distributing high-voltage power, this type of system reduces losses, cuts feeder circuit costs and improves voltage regulation. A definite requirement of process equipment switching was drawout Type DB, heavy-duty circuit breakers which can be easily inspected and maintained.

Realizing that every possible inch of floor space should be productive, the team chose Westinghouse equipment that could be installed in out-of-the-way areas yet provide on-the-spot power. For example, the maintenance-free, ventilated dry-type power center transformers are approximately 33% lighter than liquid units of same ratings. They can be mounted on overhead platforms or balconies near the loads served, but out of productive areas. Aluminum busbars in the switchgear also reduce weight and require smaller platforms to support the power center. *(cont'd.)*

YOU CAN BE SURE... IF IT'S Westinghouse

J-94147-3

At aluminum casting station, a 30-hp, totally enclosed, fan-cooled Westinghouse Life-Line® "A" motor drives a hydraulic pump. Sealed, prelubricated ball bearings eliminate greasing, while Bondite-Mylar* insulation means longer motor life, longer continuous production. Roy Angrick and V. E. Mulvaney check the installation.

*Du Pont registered trade-mark

W. E. Reimer explains to H. E. Toll and Edwin Zagrodnik how 4160-volt, unfused, 600-amp, Westinghouse Type LCB switch serves as a disconnect switch for drive motor in plant's 800-hp foil mill motor-generator set. Switch is wall mounted to save space. Westinghouse oiltite pushbutton station remotely starts motor at metal-clad switchgear.

Power comes to Mirro's plant at 67,000 kv and is stepped down to 2520/4360 volts by three Westinghouse 2500-kva, Type SL, single-phase transformers. (Fourth unit is a spare.) Transformers are protected by Westinghouse-developed Insuldur®, the ultimate in insulation, which allows peak period overloads without damage. Shown are M. E. Hutchins, V. E. Mulvaney and Edwin Zagrodnik.

Necessary 480-volt power for plant is carried from small, outdoor transformers to indoor switchgear by weatherproof, low-impedance, 1350-amp Westinghouse bus duct that assures high efficiencies of feeder circuits. Tap openings conveniently spaced along duct provide easy means of connection to power company transformers.

## Westinghouse Powers-Up Mirro Aluminum plant *(cont'd.)*

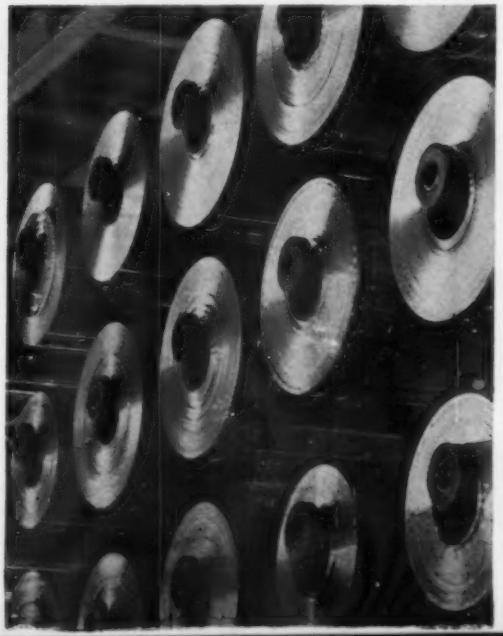
In industrial plants, Powering-Up electrically with an eye on today's *and* tomorrow's needs can mean outstanding benefits and savings. For information about how Westinghouse can help you Power-Up, see your nearest Westinghouse distribution outlet . . . or write Westinghouse Electric Corporation, Box 868, Pittsburgh 30, Pa.

OWNER: Mirro Aluminum Company, Manitowoc, Wis.
CONSULTING ENGINEER and GENERAL CONTRACTOR: Klug & Smith Co., Milwaukee, Wis.
ELECTRICAL CONTRACTOR: Uihlein Electric Co., Milwaukee, Wis.
WESTINGHOUSE DISTRIBUTOR: Westinghouse Electric Supply Co., Milwaukee, Wis.

J-94147-4

YOU CAN BE SURE...IF IT'S Westinghouse

Gleaming spools of aluminum foil produced in new Mirro rolling mill are ready for retail packaging for consumer use.



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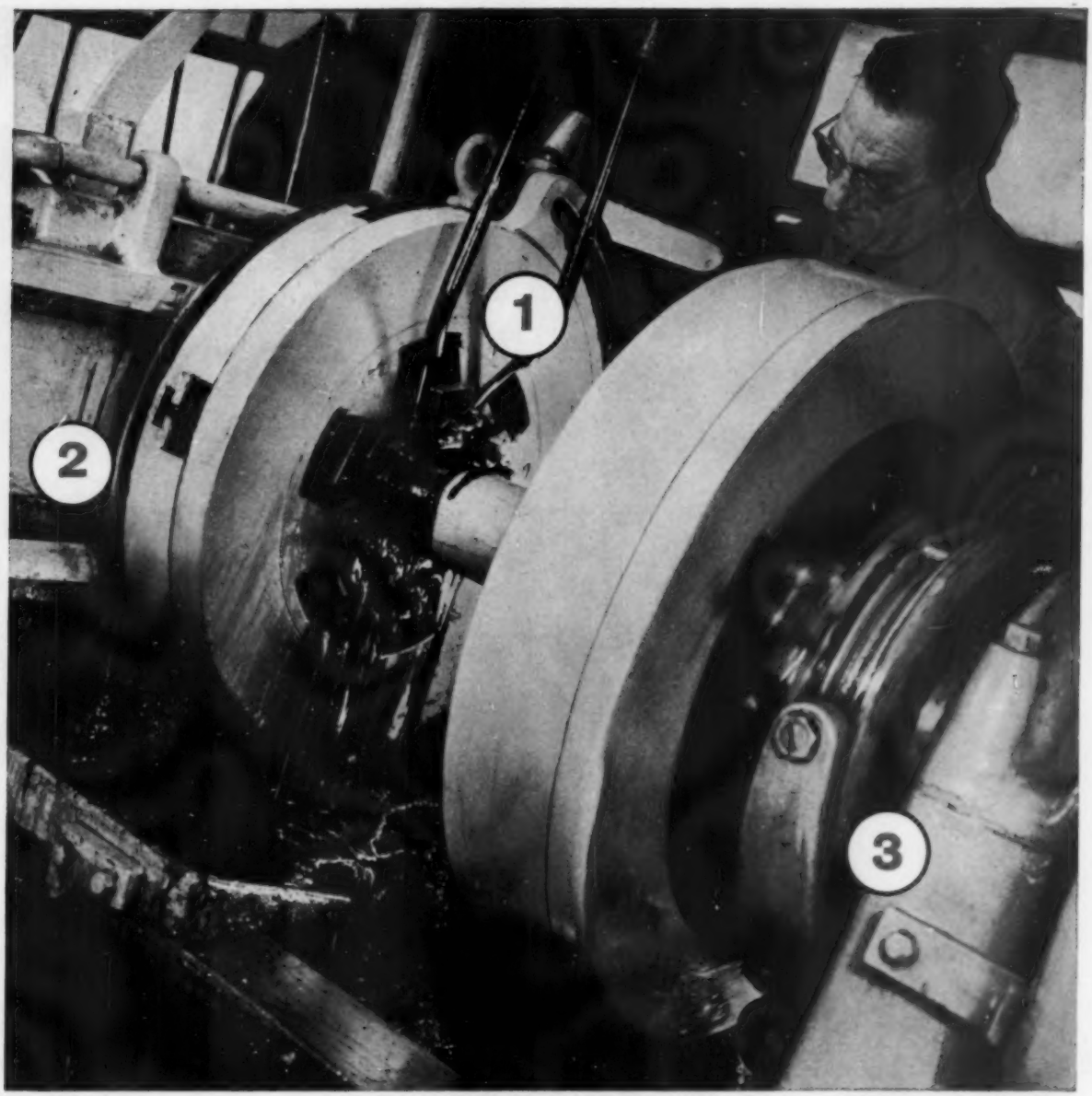


# ESSO LUBES HELP BOOST CUTTING EFFICIENCY

**1. PENNEX®** cutting oils, compounded with fatty materials, are widely used to boost cutting efficiency in threading, tapping and other machining operations on ferrous metals. Featuring high sulfur activity which provides excellent surface finish and low tool wear, Pennex cutting oils have been proven performers over many years.

**2. NUTO®** hydraulic and circulating oils are inhibited for oxidation and rust protection. They resist foaming and have a high viscosity index for hydraulic uses. They also serve efficiently in gear drives, bearings, and circulating systems.

**3. NEBULA® EP** multi-purpose grease replaces many single-purpose greases: provides high oxidation stability for long service; lubricates efficiently under high temperature conditions; serves *all* grease-lubricated points, including those where extreme-pressure properties are required.

For further information about Esso lubricants, contact your local Esso office or write: Esso Standard, Division of Humble Oil & Refining Company, 15 West 51st Street, New York 19, New York.

Esso

**In industry after industry..."ESSO RESEARCH works wonders with oil"**

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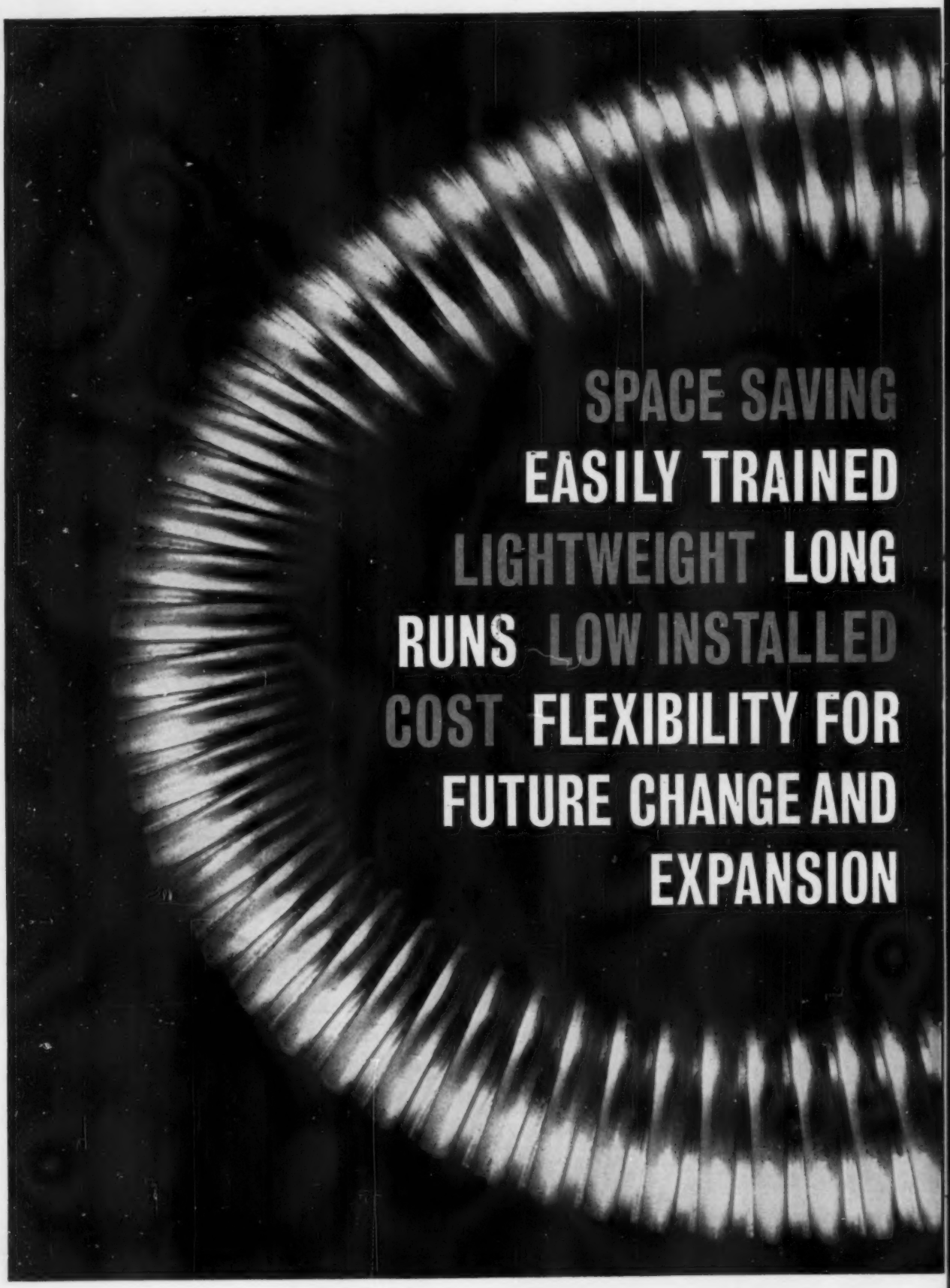
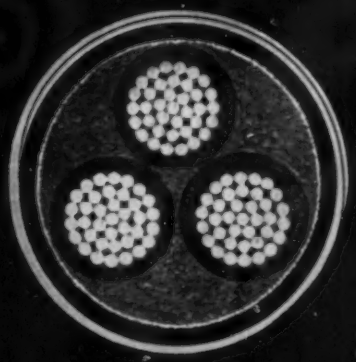

SPACE SAVING
EASILY TRAINED
LIGHTWEIGHT LONG
RUNS LOW INSTALLED
COST FLEXIBILITY FOR
FUTURE CHANGE AND
EXPANSION

# GENERAL CABLE

## INTERLOCKED ARMORED CABLE

For full protection under all conditions install General Cable Interlocked Armor...the cable for power, control, communication and lighting systems. This compact, versatile cable is available in a wide range of constructions, insulations, armors and voltage ratings. Colored polyvinyl chloride jacket over the armor can be furnished where required. "How to Obtain the Greatest Advantage Per $ Spent" a comprehensive folder detailing General Cable's complete line of Interlocked Armored Cables is available upon request. **General Cable Corporation**, 730 Third Avenue, New York 17, New York. Offices and Distributing Centers Coast-to-Coast.



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# HOW PUROLATOR HELPS SOLVE THESE FOUR COMMON IN-PLANT FILTRATION PROBLEMS

Proper filtration means reduced wear, longer life and increased efficiency for most types of machinery. It also means higher quality manufactured products because of contaminate-free process fluids.

As the world's largest, most-experienced maker of filters, Purolator has over 2,000 standard filter units available. Standard Purolator filters solve these filtration problems. Chances are, they will also solve yours. If not, Purolator will design — and make — filters that will. See your nearby Purolator distributor, or write: Purolator Products Inc., Rahway, New Jersey.

**PROBLEM: Contamination of Bulk Fluids and Semi-Fluids Before Packaging.** Despite rigid precautions, various contaminates can enter bulk fluids during processing. These contaminates may be: oxides from pipe corrosion; water from evaporation in storage tanks; tiny metal chips from machinery; or foreign matter picked up from the atmosphere.

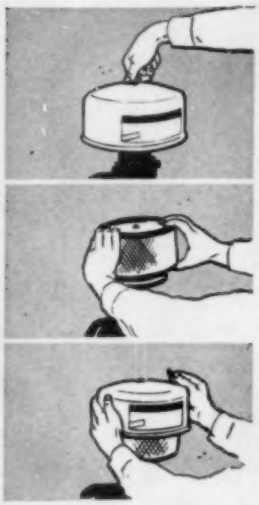
**SOLUTION:** Purolator Model G-141J Metal Edge Filter is ideal for filtering most bulk fluids just before packaging. These fluids might include: inks, varnishes, food products, greases; process fluids, or lube and fuel oils.

The G-141J's filter element is permanent . . . made of precisely-spaced metal ribbon wound into cylinder form. Capacity ranges from 6 to 200 GPM. Filtration . . . from 25 to 500 microns. Installation can be made on either pressure or suction side of pump. If desired, filter is also available in stainless steel.

**Continuous, Permanent Filtration.** Cleaning the G-141J is simple, too. No need to disassemble the unit or stop the flow of fluid. Turning handle rotates metal edge filter unit against fixed knife-blade which shears off waste. This is periodically removed through plug at bottom. If service warrants, filter element can be rotated continuously by motor drive.

**PROBLEM: Air-Filter Maintenance.** Removing, washing and re-oiling ordinary oil-bath type air filters is a time-consuming (and expensive) chore. What's more – this type of unit is relatively inefficient. Clogs easily and then lets abrasive-laden air into the engine.

**SOLUTION:** Purolator Micronic filter elements can be replaced in seconds. Special accordion pleating means 9-14 feet of filter area – 10 times that of most competitors. Controlled porosity filters out particles as small as .000039 of an inch. Models up to 1,000 CFM available.



**Service in Seconds.** Here's all you do to service a typical Purolator Dry Type Micronic Air Filter:

1. Loosen wing nut. Remove cover and dirty refill.
2. Replace with a new Purolator Micronic refill.
3. Replace cover and tighten wing nut.

Purolator refills are inexpensive. However, filter element life can be extended by cleaning. This is done by applying reverse flow of low pressure air through element.

**PROBLEM: Incomplete Filtration of Lubricating Oil.** Various bleeder, bypass, shunt and similar partial flow systems often used on machine tools and large engines can cause damaged parts and excessive wear because contaminates are permitted to pass into the engine.

**SOLUTION:** A Purolator Micronic Filter of correct size can handle full lubricating oil flow for even the largest engines. The protection this kind of filter gives the engine exceeds anything a partial flow arrangement could accomplish.

**Full-flow lube oil filtration.** Pictured above is a typical Purolator Micronic Filter, Series P-32.

**PROBLEM: Diverse Filter Requirements of Hydraulic Circuits.** Without proper filtration, most hydraulic circuits would soon break down. Yet even a small plant has many different hydraulic circuits – each one requiring a specific type of filter.

**SOLUTION:** Purolator's complete line of filters for hydraulic systems is the most comprehensive of its kind. Models include: suction strainers to protect pumps; high-pressure filters to protect delicate control valves; and low-pressure filters for return circuits.

**Complete line of filters for all hydraulic circuits.** Here are just a few standard units. Filter media include: Micronic, metal edge and wire cloth.

*Filtration For Every Known Fluid*

**PUROLATOR**

**PRODUCTS, INC.**

RAHWAY, NEW JERSEY AND TORONTO, ONTARIO, CANADA

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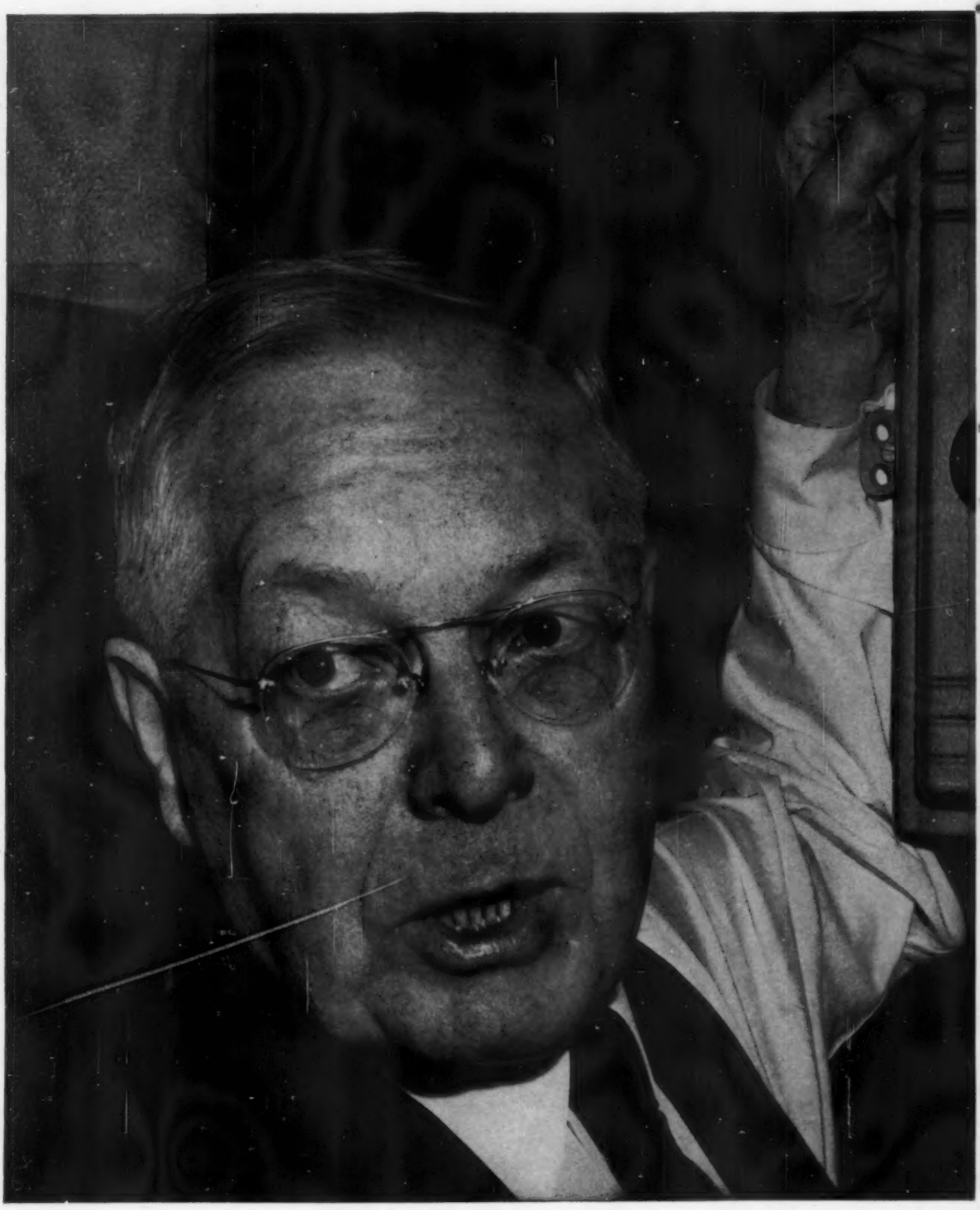
# "Nobody was going to pin an



# 'old-fashioned' label on me"

"Funny how easy it is to get behind the times. Like I was before I learned about circuit breakers. But nobody can say I'm not up-to-date now.

"All of a sudden, I began noticing the modern, enclosed circuit breakers in use by other plants . . . for machines, lights and production area outlets. Really up-to-date plants use them for practically everything. And engineers tell me they won't take anything else.

"Well, I decided to find out why. And today I use circuit breakers exclusively. What a difference. If we have an overload, we get power back in minutes . . . without idling people and losing production. And my job is easier and a lot safer.

"Cost? Shucks, a circuit breaker saves a whole lot more in production time than it costs new. Today there's darn little excuse for anybody not to use them.

"Here's something else I learned. The guys who really know circuit breakers use I-T-E over any other brand."

Send for the new free bulletin on how circuit breakers benefit industrial plants. Or see your distributor. Write I-T-E Circuit Breaker Company, Dept. SA, 1900 Hamilton St., Philadelphia 30, Pa.

**I-T-E CIRCUIT BREAKER COMPANY**

For more facts circle 563 on Reply Card

*Reporting more news from . . .*

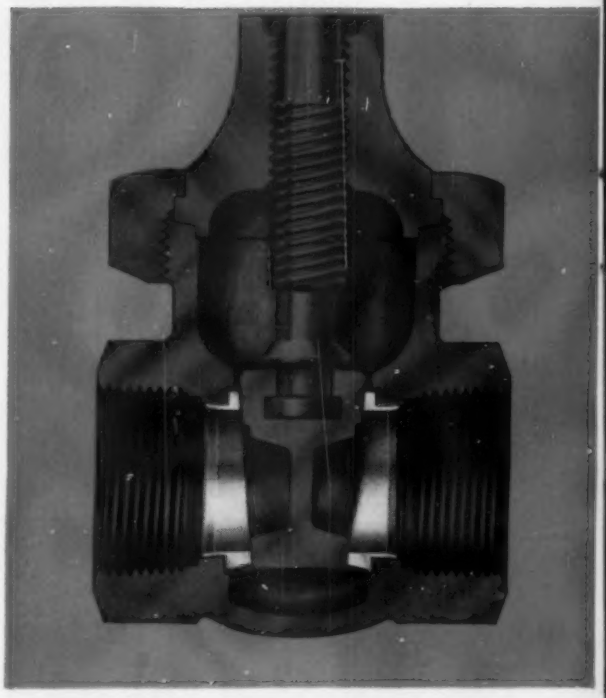
**CRANE**
***DIRECTION '70***

. . . a fast-moving program of planned expansion, product development, and streamlined distribution to help our customers meet the competitive challenges of the Sixties.

# Only from Crane—this rugged bronze valve in a full range of pressure classes and sizes

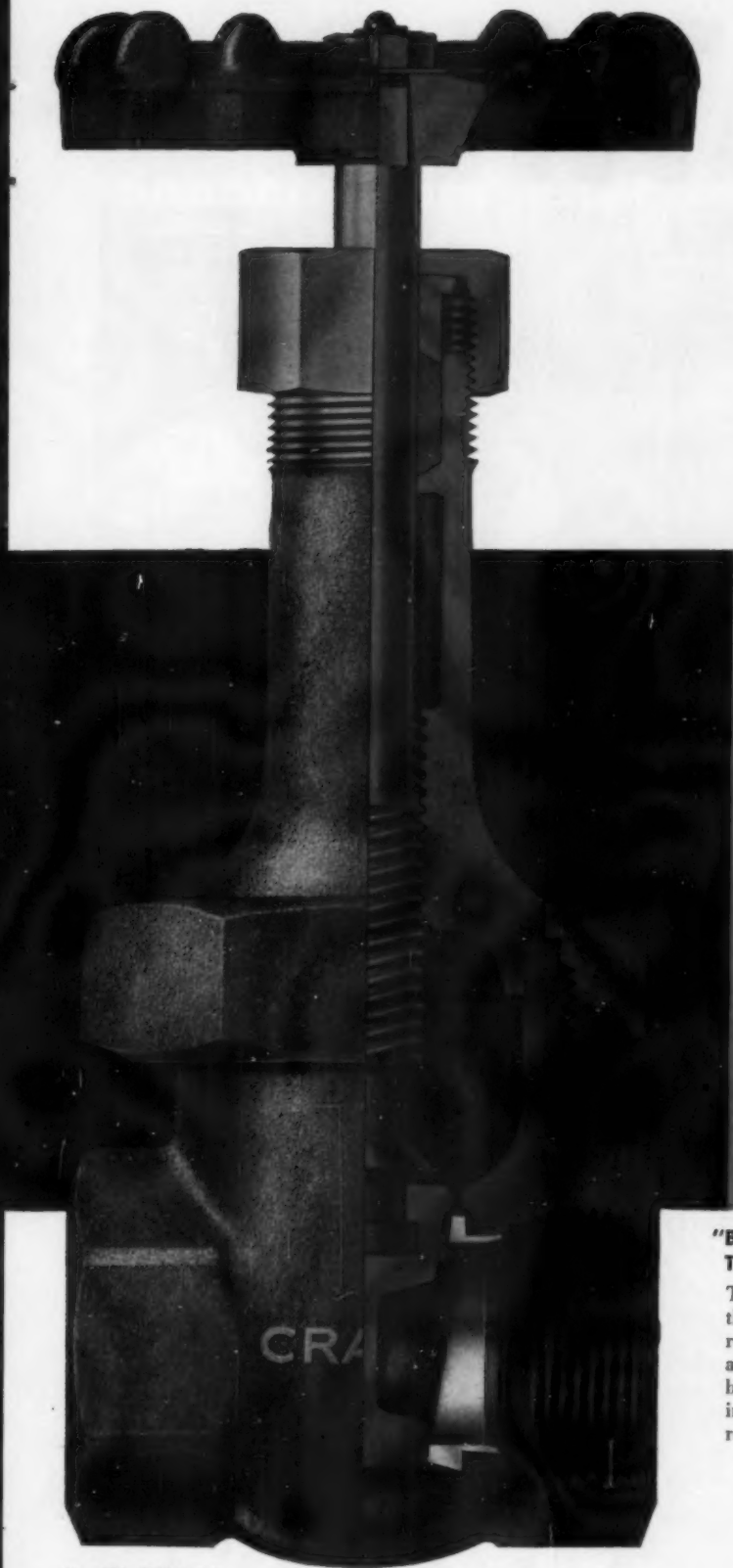
Use these on your toughest services! Here are valves with a built-in safety factor that far exceeds minimum standards. Modern, cylindrical body design—the same as used on high-pressure steel valves—gives you extra protection against body distortion that causes leaks. Crane Exelloy seat rings defy operating wear and damage from foreign matter...drastically reduce your valve maintenance costs. And you get this extra performance at no more cost than you pay for a valve built to only minimum standards.

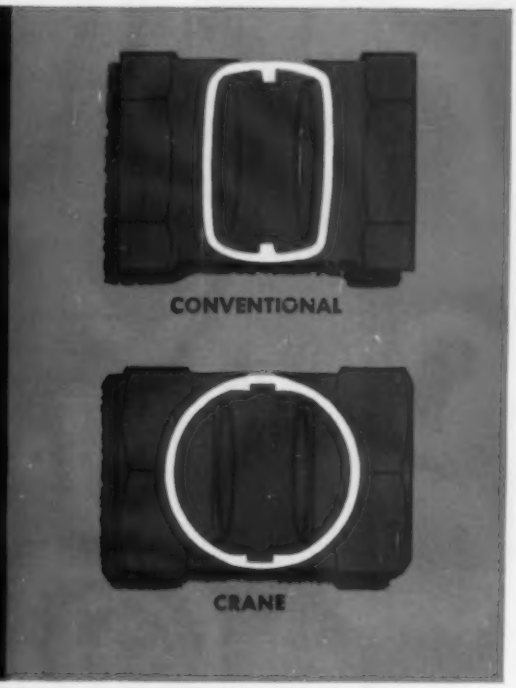
In addition to all these quality features, Crane gives you a far wider selection than any other comparable bronze valve line . . . a full range of sizes from ¼" to 3" . . . in both 200-pound and 300-pound pressure classes . . . in both rising stem and non-rising stem patterns. Your local Crane Distributor has these valves in stock and can ship your order without delay.



**THANKS TO EXELLOY SEATS, ONLY THE REPLACEABLE DISC GETS THE WEAR**

Crane Exelloy (12% chromium steel) seat rings, expanded into body, give a hard bearing surface with superior resistance to wear, indentation, or scoring. Normal seating wear is shifted to the easily replaceable bronze wedge disc. Ordinary bronze valves wear on both disc and seat, an expensive maintenance factor. But with this Crane bronze valve you need only slip in a new disc to get a like-new, tight-seating valve.






**"BEEFED-UP" BODY DEFIES DISTORTION TO MAINTAIN TIGHT SEAL**

This Crane bronze gate valve has a cylindrical body . . . the best design to withstand internal pressures. Ordinary rectangular body design creates stress concentration at corners, which may result in distortion of the valve body causing leakage or early failure. Huskier, better integrated Crane design has more rigidity under strains, reinforces seats against wedging action of disc.

No. 424; 200 Pound
No. 634E; 300 Pound

CRANE®

Crane Co., Industrial Products Group, 4100 S. Kedzie Ave., Chicago 32, Ill.

VALVES • ELECTRONIC CONTROLS • PIPING • PLUMBING • HEATING • AIR CONDITIONING

For more facts circle 564 on Reply Card

# PLATING

## AAF Type M Cycoils eliminate fumes from small parts plating at Burroughs

● Burroughs had a fume problem resulting from inadequate make-up air and heavy fume loading from tank agitation. Their answer: a ventilating system built around new units designed *specifically* for plating fume collection—AAF Type M Cycoils. These units achieve higher collection efficiencies than conventional collectors, yet are lighter, less bulky and lower in cost.

AAF's complete line of dust control equipment was application-developed, now challenges *any* metalworking dust problem, regardless of the metal. Where are dust, fumes or mists causing you trouble—grinding, buffing, polishing, plating, dry machining, wet machining, heat treating, abrasive cleaning? All can be effectively and economically controlled by AAF.

For the answer to your plating fume problem, call your local AAF representative, or write for Bulletin 286. Address: Mr. Robert Moore, American Air Filter Company, Inc., 228 Central Avenue, Louisville, Ky.

**American Air Filter**

BETTER AIR IS OUR BUSINESS

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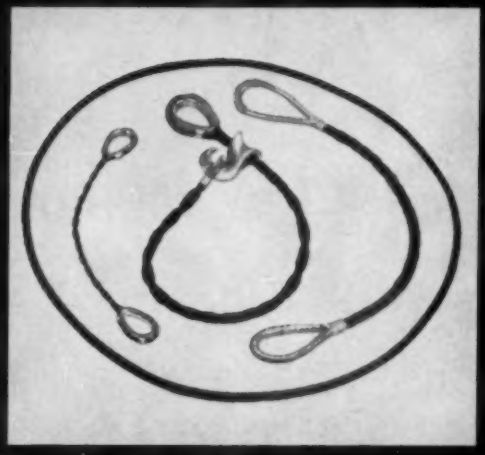
**For more facts circle 566 on Reply Card** →

# HERE'S THE CORRECT WIRE ROPE FOR ALL YOUR EQUIPMENT

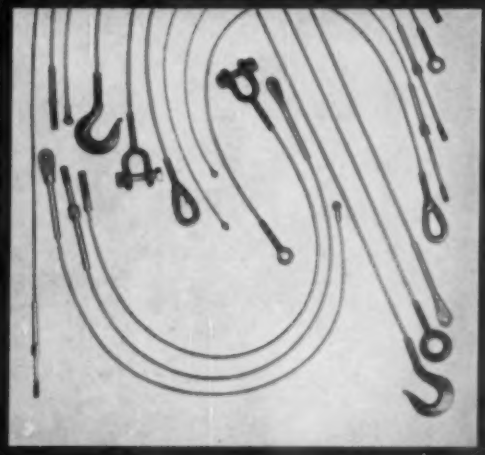
## WIRE ROPE

You can choose from a thousand-and-one types, sizes, and grades of Macwhyte Wire Rope to get exactly the right rope for your equipment. Properly lubricated and fabricated to give long, low-cost service. Write for Catalog G-16.



## SLINGS

Safe, easy-to-handle Macwhyte slings are available in Round-braided, Flat-braided, or single-part body styles as standard designs or custom-made to your requirements. Write for Catalog S-8.



## CABLE ASSEMBLIES

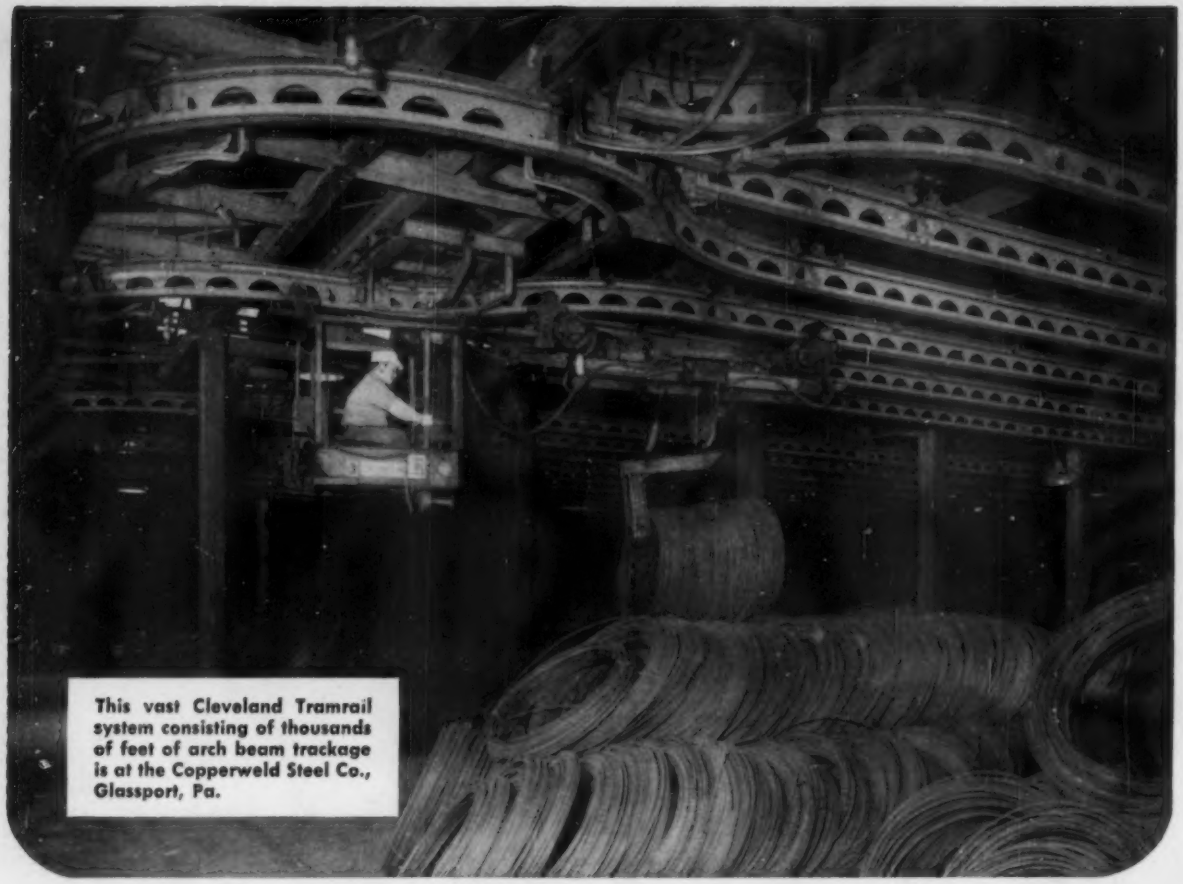
Safe-Lock wire rope assemblies are precision made to your order in the size, length, and strength needed. Available in uniformly high quality with fittings permanently swaged to the rope. Write for Catalog 5601.

# MACWHYTE Wire Rope COMPANY

2900 Fourteenth Avenue, Kenosha, Wisconsin, U. S. A.

Wire Rope • Slings • Cable Assemblies • *Distributed and Stocked throughout the United States.*

192



This vast Cleveland Tramrail system consisting of thousands of feet of arch beam trackage is at the Copperweld Steel Co., Glassport, Pa.

# The *Most Practical* and *Lowest Cost* Method of Handling Wire and Rod

The headline words refer to overhead materials handling equipment and are powerfully strong, we admit. Yet we do not know of one engineer who is closely connected with the industry and experienced with all methods of handling, who will disagree.

Mills, large and small, from coast to coast, in the United States and Canada, have invested many millions of dollars in Cleveland Tramrail equipment to speed their wire and rod handling. The dividends that this huge investment has made possible, because of low-cost handling, have returned the original capital many times over.

If your company does not now enjoy the many benefits of Cleveland Tramrail, we urge you to get the "low-down" on what this equipment can do for you. A nearby sales engineer will be glad to give you the details without obligation.

***GET THIS BOOK!***

BOOKLET No. 2008. Packed with valuable information. Profusely illustrated. Write for free copy

**CLEVELAND TRAMRAIL DIVISION**
THE CLEVELAND CRANE & ENGINEERING CO.
7512 E. 288 Street, WICKLIFFE, OHIO.

**CLEVELAND TRAMRAIL**
**OVERHEAD MATERIALS HANDLING EQUIPMENT**

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# THE V IS THE THING

## 25% UPLIGHT

**BETTER LIGHTING QUALITY**
**BETTER WORKING ATMOSPHERE**
**10% BETTER MAINTENANCE**

## GUTH WYTELINER INDUSTRIALS

Their V-shaped center reflector can't trap dirt or dust. Therefore, it stays clean far longer than flat-center reflector units.

Guth 25% Uplight fixtures produce powerful downlighting and afford 27° normal shielding. They wash away gloom and overhead shadows, improve eye comfort and working conditions . . . assure maximum lighting efficiency, plus less maintenance, even under the poorest area conditions.

Units available for 430, 800 or 1500 M. A. operation.

**WRITE FOR NEW INDUSTRIAL BROCHURE NOW!**

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**A GUTH EXCLUSIVE!**
**KOLORKODED**
**INDUSTRIAL FIXTURES**
**WITH BUILT-IN TRAFFIC LIGHTS**

. . . red, green and yellow "signals" to direct traffic, protect workers, identify plant or storage areas.

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Utilizes Westinghouse silicon high-voltage rectifier cells

# 25% MORE EFFICIENT

buell Norblo®

## You get more power...reduce maintenance...increase reliability when you convert to Buell Silicon Rectifier Units

Buell Silicon Rectifier units can increase efficiency of your rectifiers 25% or more ■ Perfected and specifically designed for fast, simplified conversion of existing mechanical or tube rectifiers ■ They cut operating costs, reduce overall maintenance ■ Enable more efficient utilization of power ■ Eliminate rectifier maintenance ■ Reduce outages ■ Reclaim plant space ■ Suitable for indoor or outdoor installation ■ For only a small investment you can materially improve your rectifier performance ■ For details of the unit and a specific proposal write: Buell Engineering Co., Dept. 12-J, 123 William Street, New York 38 ■ Northern Blower Division, 6423 Barberton Ave., Cleveland, Ohio ■ CYCLONES, ELECTRIC PRECIPITATORS, BAG COLLECTORS, COMBINATION SYSTEMS, CLASSIFIERS, FANS.

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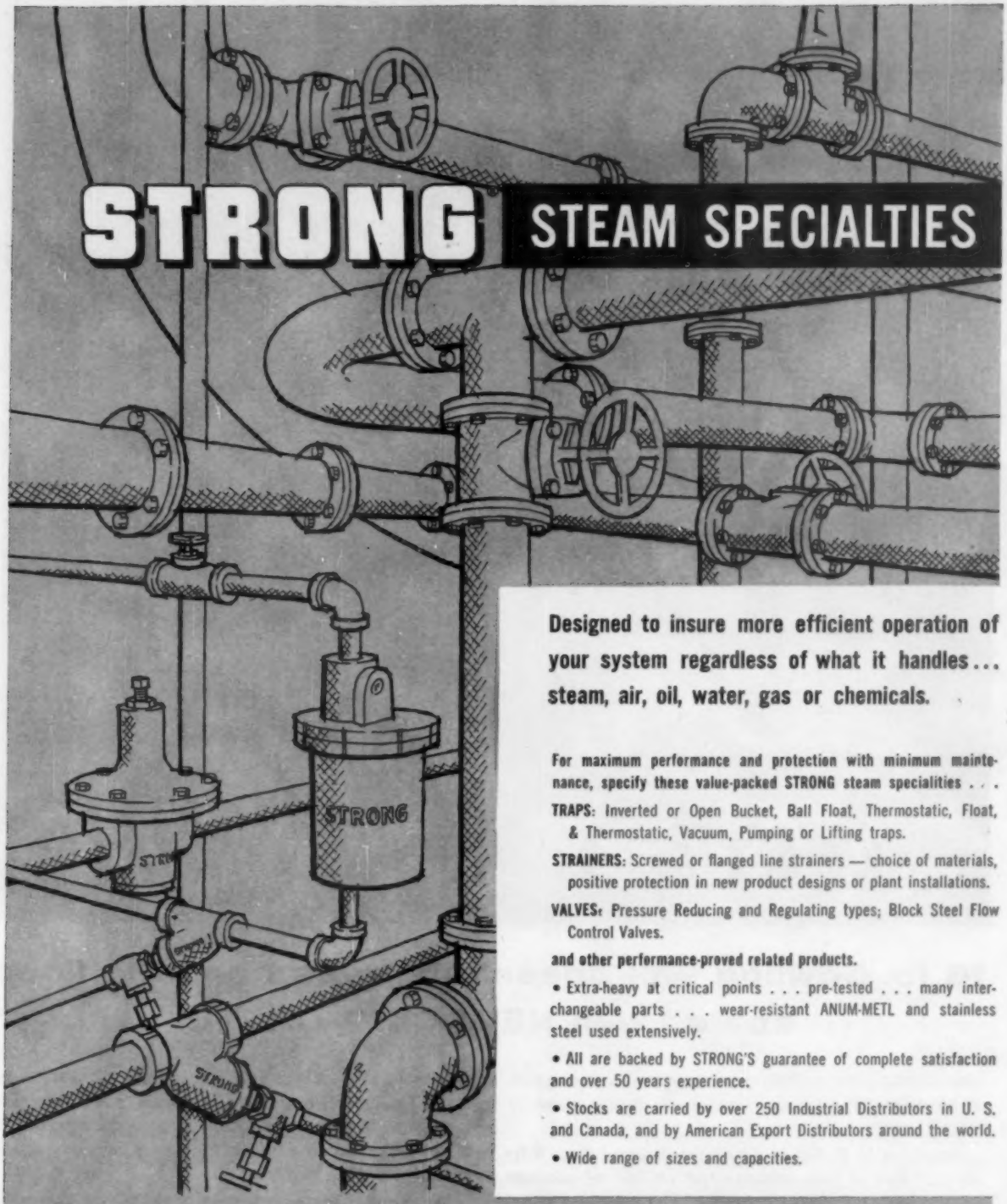


# STRONG STEAM SPECIALTIES

**Designed to insure more efficient operation of your system regardless of what it handles... steam, air, oil, water, gas or chemicals.**

**For maximum performance and protection with minimum maintenance, specify these value-packed STRONG steam specialities . . .**

**TRAPS:** Inverted or Open Bucket, Ball Float, Thermostatic, Float, & Thermostatic, Vacuum, Pumping or Lifting traps.

**STRAINERS:** Screwed or flanged line strainers — choice of materials, positive protection in new product designs or plant installations.

**VALVES:** Pressure Reducing and Regulating types; Block Steel Flow Control Valves.

**and other performance-proved related products.**

- Extra-heavy at critical points . . . pre-tested . . . many interchangeable parts . . . wear-resistant ANUM-METL and stainless steel used extensively.
- All are backed by STRONG'S guarantee of complete satisfaction and over 50 years experience.
- Stocks are carried by over 250 Industrial Distributors in U. S. and Canada, and by American Export Distributors around the world.
- Wide range of sizes and capacities.

**STRONG, CARLISLE & HAMMOND** / **508 Sandusky Street, Conneaut, Ohio**

***FOR FAST AND RELIABLE SERVICE...*** Buy from your local Industrial Distributor

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# 16 lb. bowling ball doesn't impress concrete floor coated with NEW GLID-CRETE

New GLID-CRETE, a catalyzed epoxy resin, used to patch or resurface floors is six times more impact resistant than concrete.

Proof—a 16 lb. bowling ball was dropped from 6 ft. on a 3″ slab of bare concrete and on 2¾″ of concrete coated with ¼″ of GLID-CRETE. The concrete split, chipped and cracked. Concrete coated with GLID-CRETE was smooth as new, not a dent.

Easy to apply with spray or trowel, GLID-CRETE is highly resistant to most of the chemicals used in processing plants. It offers many outstanding advantages in the maintenance, repair and construction of masonry floors and structures.

Write today for complete information on how new GLID-CRETE can save you time, money too.

QUALITY Glidden PRODUCTS

MAINTENANCE FINISHES DIVISION
The Glidden Company
900 Union Commerce Building
Cleveland 14, Ohio
In Canada: The Glidden Company, Ltd., Toronto, Ontario

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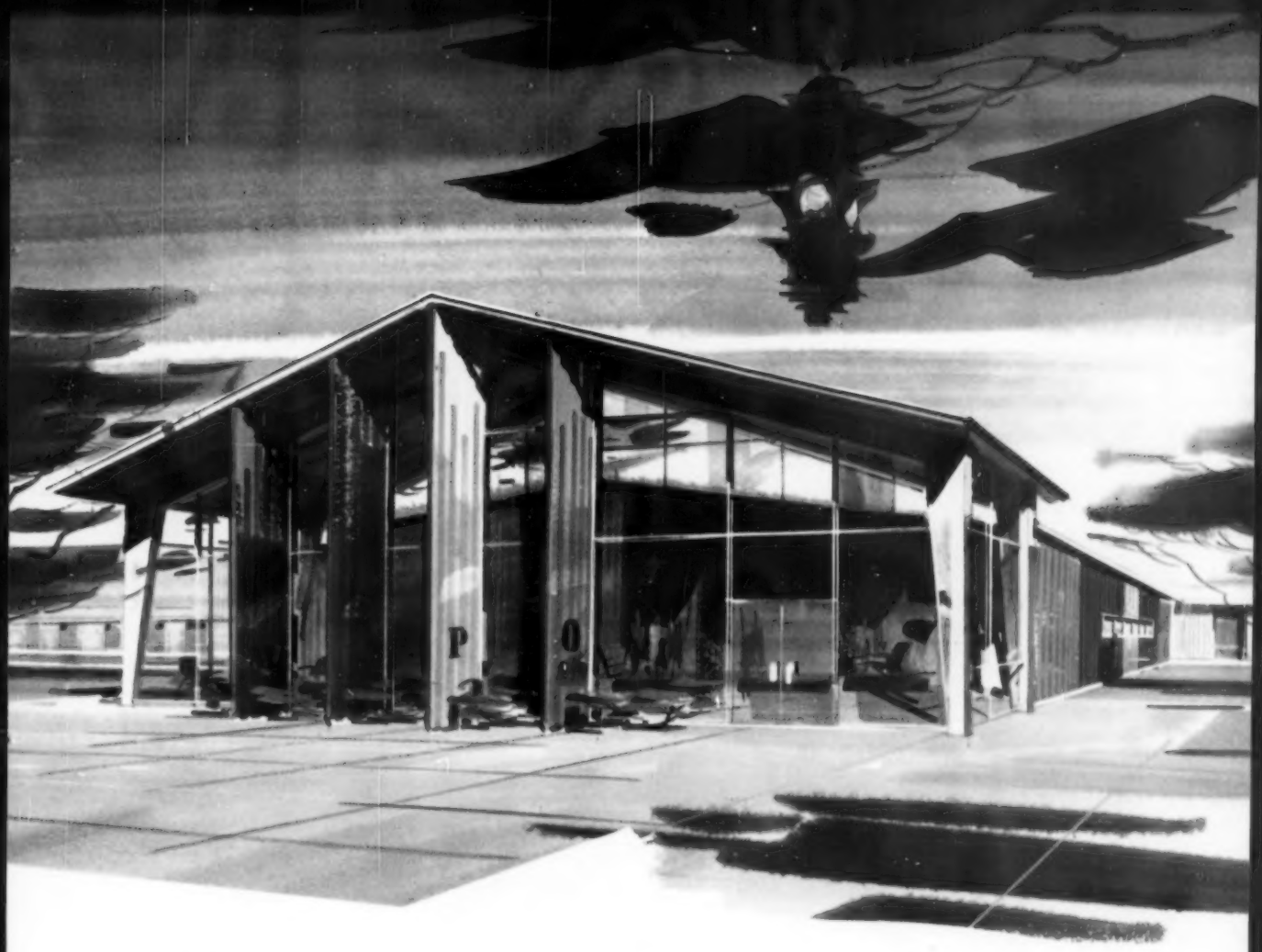

# Handsome is and handsome does

**...colorful Butler Buildings are functional too!**

It's no accident that Butler buildings are finished with the most striking *and* protective color offered in the industry—Butler-Tone™. Butler alone uses America's number one system of pre-coating metal panels. Butler alone coats both sides. Butler-Tone adds extra years of new-looking color and time-defying protection.

Add Butler-Tone colors to the industry's two outstanding wall systems, the widest range of sizes and types of rigid frame clear-span structurals, optional roof guarantee at nominal cost, the skills and experience of the finest nationwide Builder organization in the industry—and you have America's number one pre-engineered building value.

TURN THE PAGE TO SEE WHAT COLORFUL BUTLER BUILDINGS WILL DO FOR YOU...

CELEBRATING 60 YEARS
BUTLER
FABRICATING METALS

# Coast to Coast

...industry finds advantages in

**BUTLER BUILDINGS**

*Flick-Reedy Manufacturing Corporation, Bensenville, Illinois, winner of Factory Magazine's 1960 "Plant of the Year" award.* ARCHITECT: *Zay Smith & Associates, La Grange, Ill.,* DESIGNER: *Norman Steenhof.*

Manufacturing . . . warehousing . . . distribution, industry finds that the Butler Building System suits all three functions.

. . . like floor space. Clear-spans bridge areas up to 120 feet.

. . . like overhead space. Rigid frame design provides space for lights, craneways, other fixtures. Raw and finished inventories stack to maximum pallet heights.

. . . like expandability. Adding to a Butler is easy, fast, economical . . . with practically full salvage of original materials.

No, there's nothing nebulous about the advantages our customers associate with Butler industrial buildings. Your Butler Builder (see "Buildings" or "Steel Buildings" in the Yellow Pages) will be happy to discuss other advantages, including financing. Call him . . . or write direct.

*Southwestern Plastics, Houston, Texas*

"See Sweet's Industrial or Architectural File—Section 8-B"

MBMA

BUTLER

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Manufacturers of Metal Buildings • Plastic Panels • Equipment for Farming, Transportation, Bulk Storage, Outdoor Advertising • Contract Manufacturing

Sales offices in Los Angeles and Richmond, Calif. • Houston, Tex. • Birmingham, Ala. • Kansas City, Mo. • Minneapolis, Minn. • Chicago, Ill. • Detroit, Mich. • Cleveland, Ohio • New York City and Syracuse, N. Y. • Washington, D. C. • Burlington, Ontario, Canada

*District office for Westinghouse Electric Supply Company, Worcester, Mass., one of six Butler buildings recently completed for The Westinghouse Electric Supply Company throughout the country.*

*"R-W Fire Doors actually kept us in business. They saved our warehouse and inventory of over 7000 vending machines, permitting us to meet shipment orders while new production facilities are under construction."*

*. . . states Mr. Waldo E. Bolen, Vice President*
*The Northwestern Corporation,*
*Morris, Illinois*

TWO SIDES OF THE SAME R-W FIRE DOOR

# R-W "FyeR-Wall" FIRE DOORS AGAIN PROVE THEIR VALUE!

Fire broke out in the production department of the Northwestern Corporation, manufacturers of vending machines, early one morning. In just a few hours the complete production facilities and adjoining offices were destroyed . . . a loss estimated at over $500,000.00. The adjoining warehouse that was separated from the production department by R-W "FyeR-Wall" No. 347 Corrugated Steel Fire Doors, was not damaged. The photos above provide graphic testimony to the value of R-W Fire Doors. While the fire wrought havoc on the production department side of the doors, the roaring inferno was stopped from entering the warehouse. The extreme fire damage is evident in the photo above left, while the warehouse area, photo above right, is clean and free from fire or smoke damage.

R-W Fire Doors are Underwriters and Factory Mutual Laboratories approved for class A, B, C, D, E and F openings. "FyeR-Wall" Corrugated Doors are but one of many types of fine Doors offered by R-W . . . each type is designed to offer specific characteristics to meet various requirements. Complete hardware for single or double link operation.

Write today for complete information on how R-W Fire Doors will provide added safety for your plant . . . request your free copy of Catalog No. A-420.

**Richards-Wilcox**
**MANUFACTURING COMPANY**
**A HANGER FOR ANY DOOR THAT SLIDES**
460 W. THIRD ST. • AURORA, ILL. • Branches in Principal Cities

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# CELANESE CELLULUBES used as air compressor lubricants step up safety in new missile submarines...

The advantages of Celanese Cellulubes were clearly apparent after a test program by Electric Boat Division. The tests included a study of lubricants dispersed in air under high pressure, followed by abrupt decompression. This results in a high-speed shock wave which can cause a violent explosion. Hydrocarbon lubricants proved highly vulnerable, but Cellulubes were so effective in resisting these extreme conditions that they will be used in all compressors in the new Polaris Fleet Ballistic Missile Submarines.

Cellulubes are not only outstanding for the prevention of fire and explosion, they give overall wear protection comparable to that of premium petroleum oils. The resistance of Cellulubes to carbon formation eliminates frequent scraping and cleaning of charred residues from valves and other internal parts of reciprocating compressors. Celanese Cellulubes can reduce maintenance requirements for compressors and often for downstream equipment as well. Celanese Chemical Company, a Division of Celanese Corporation of America, New York 16.

Celanese® Cellulube®

**NEW 20-PAGE MANUAL...**
shows you the causes of fire and explosion in compressed air systems, based on latest research. This booklet is intended to help plant engineers and management reexamine specifications in the light of the benefits that Cellulube fire-resistant lubricants offer. Send for your copy today.

CELANESE CHEMICAL COMPANY
A DIVISION OF CELANESE CORPORATION OF AMERICA
DEPT. 585-K, 180 MADISON AVENUE, NEW YORK 16, N.Y.

Please send me a copy of your manual on synthetic lubricants for air compressors.

Name_____ Title_____

Company_____

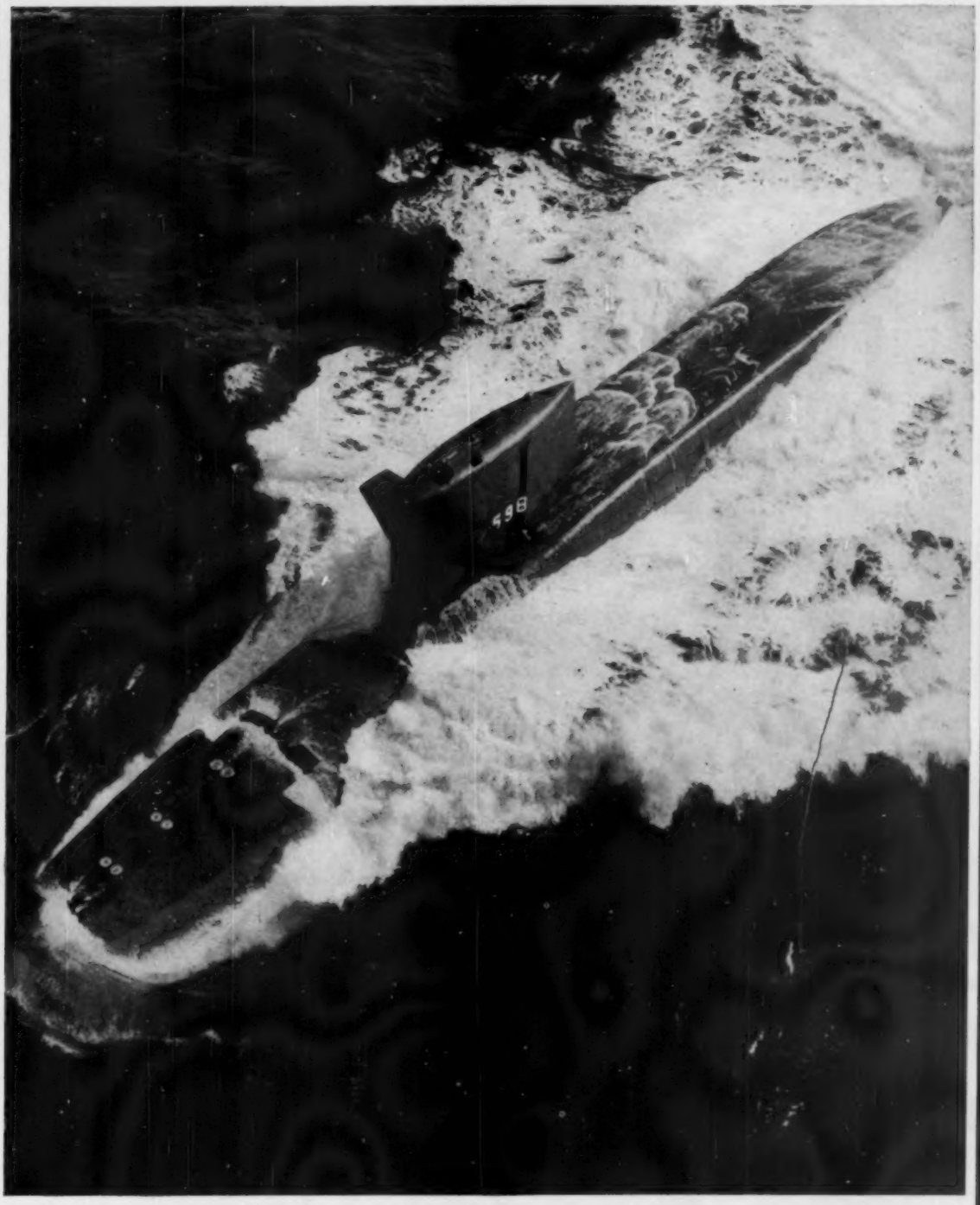
Address_____

City_____ Zone_____ State_____

Application I have in mind_____

Factory Mutual-Approved
(Cellulubes 150 and 220)

FM

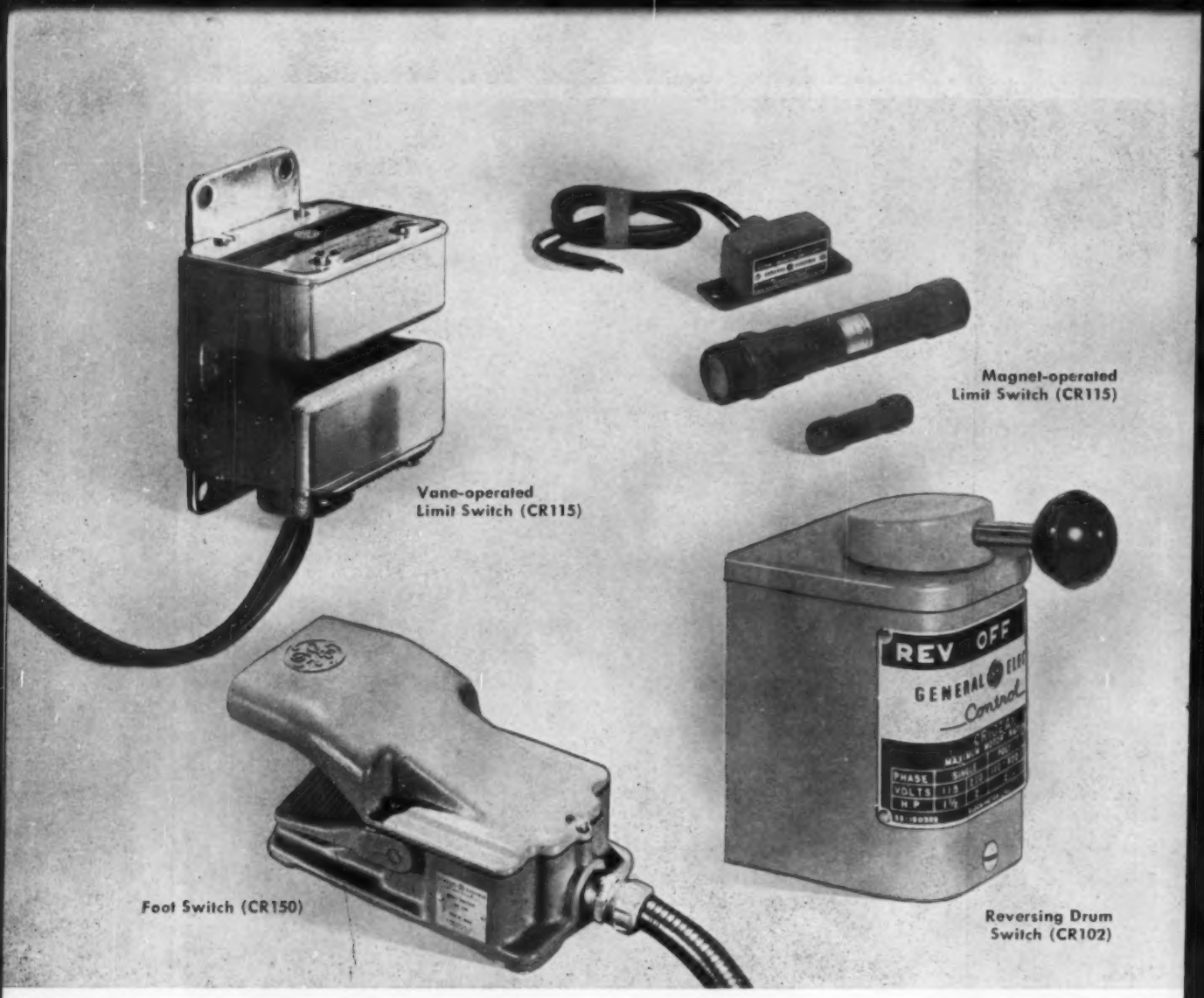


Like all other Polaris Fleet Ballistic Submarines, the U.S.S. GEORGE WASHINGTON uses Cellulube 550 for its air compressors. (Built by Electric Boat Division of General Dynamics Corporation, Groton, Conn.)

**Cellulubes...** Celanese CHEMICALS **fire-resistant functional fluids**

In Canada: Canadian Chemical Company Limited, Montreal, Toronto, Vancouver • Export Sales: Amcel Co., Inc., and Pan Amcel Co., Inc., 180 Madison Ave., New York 16, N.Y.

CELANESE CELLULUBES




*AVAILABLE NOW . . . More Measurable Advantages From General Electric Control:*

# In 1960 Alone . . . 9 NEW Devices

Progress at General Electric's Control Department means important benefits for you—distinct and valuable advantages that can be measured in terms of time and money in your own operation. We invite you to evaluate these benefits for yourself.

**NEW VANE-OPERATED LIMIT SWITCH (CR115)** gives from 30 to 50 million operations! Performs position-detection function of conventional switches *without physical contact* by passing a vane through a slot. The vane magnetically operates a contact. Switch is encapsulated to seal out contaminants. Bulletin GEA-6995.

**NEW MAGNET-OPERATED LIMIT SWITCH (CR115 A19)** *eliminates* physical contact with levers, arms, rods, or shafts. Performs position-detection function where precise control of moving object is not possible or where there is no opportunity to run a vane through a slot. Detects erratic motion on such applications as overhead conveyors. Oil-, dust-, and water-tight. Bulletin GEA-7305.

**NEW FOOT SWITCH (CR150)** offers rugged, cast-iron construction—will not skid during operation. Water-, oil-, and dust-tight switch is available in single- or two-stage forms with or without guard. Bulletin GEA-7086.

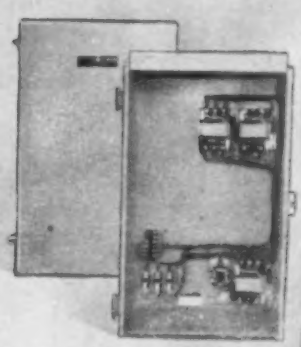
**NEW REVERSING DRUM SWITCH (CR102)** can be changed from maintained to momentary contact in seconds—without tools! Gives exceptional durability, positive "feel." *Easy* to wire and install. Bulletin GEA-7000.

**NEW MINIATURE OIL-TIGHT PUSH BUTTONS (CR104)** cut your panel space requirements *at least* 40 percent. Complete new line offers buttons, selector switches, illuminated buttons and indicating lights. Color coding available in both rings and buttons. Bulletin GEA-7127.

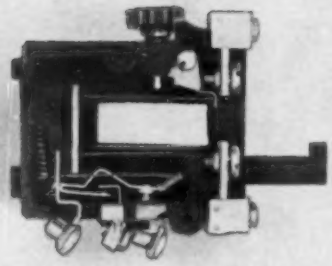
**NEW WYE-DELTA REDUCED VOLTAGE STARTERS (CR132, CR7053)** provide low inrush current resulting in low starting

## You get MEASURABLE ADVANTAGES
### WITH GENERAL ELECTRIC CONTROL

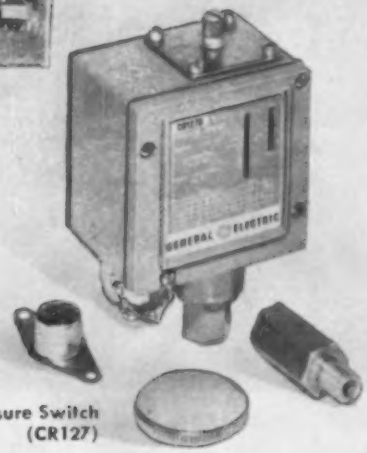
Miniature Oil-tight Push Buttons (CR104)



Wye-delta Reduced Voltage Starters (CR132, CR7053)



NO-NC Overload Relay (CR124)




Pressure Switch (CR127)

Stainless Steel Starter Enclosures (CR107, CR108, CR1062, CR7008)

*Longer Life, Space Savings, Increased Flexibility, Better Protection*

# for Better Control in Your Plant

torque. Two types are available: Open transition, which is particularly suitable for long-time acceleration; and closed transition (auto transformer) which minimizes current or torque dips. Bulletin GEA-6860.

**NEW STAINLESS STEEL STARTER ENCLOSURES (CR107, CR108, CR1062, CR7008)** for use where corrosion is a problem—give neat appearance, match other equipment. Switch handles are chromium-plated; hardware and mounting feet, stainless steel. Enclosures provide watertight protection. A complete line of enclosures is available for manual and magnetic across-the-line starters.

**NEW NO-NC OVERLOAD RELAY (CR124),** a two-circuit relay for use with signalling devices such as indicating lights or alarm bells, assures positive visible or audible overload detection.

**NEW PRESSURE SWITCH (CR127)** features visible trip indicator and calibrated range scale in cover. Unique neon pilot light indicator is optional. Low- and high-pressure forms are available in both bellows or piston types. Bulletin GEA-7302.

For more information on the *measurable advantages* of these new General Electric control devices, contact your G-E Apparatus Sales Office or Authorized Distributor or write to Section 813-27, General Electric Co., Schenectady 5, N. Y. for the bulletins listed.

*Progress Is Our Most Important Product*

**GENERAL ELECTRIC**

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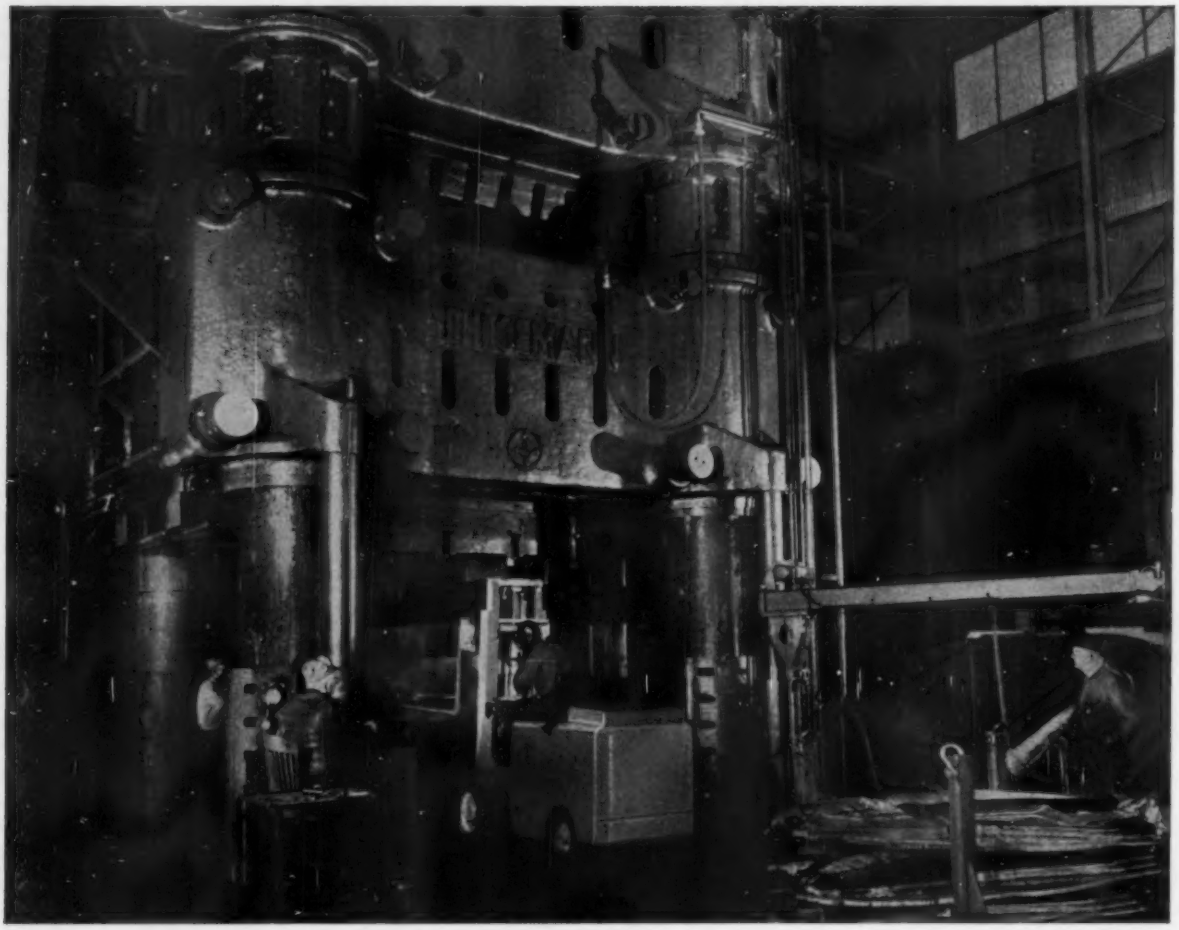


# Get full production from electric trucks— Power with C&D *Slyver-Clad*® batteries!

Records from many types of operations prove electric trucks are best for materials handling operations requiring industrial trucks. And when you power them with premium C & D *Slyver-Clad*® batteries, you get maximum capacity per unit of space. This in turn means continuous, full-production, without power letdown at the end of a shift.

In addition, C & D premium *Slyver-Clad* batteries have *Hi-Impac* cell covers and containers. This *exclusive* C & D feature alone virtually eliminates taking a truck out of service because of physical damage to the battery.

C & D batteries have Five-Fold *Slyver-Clad* insulation and retention that assures maximum life with full capacity to the end of that life, plus *AccuPak*® plates that are automatically pasted and 100% inspected by AccuRay**. They are the longest, thickest plates available in any industrial battery. You get built-in extra life and the AccuRay inspection eliminates any possibility of trouble because of low cells.

C & D premium *Slyver-Clad* batteries are available with capacities from 225 to 2175 A.H. at the six hour rate and in any standard tray arrangement. Write for Bulletin IT-528 and see why *—C & D is your better battery buy.*

C&D C & D BATTERIES
*of Conshohocken, Pa.... Attica, Ind.*
DIV. THE ELECTRIC AUTOLITE CO.

**Manufacturers of Slyver-Clad® Industrial Batteries • PlastiCell* and PlastiCal® Batteries for Communications, Control, and Auxiliary Power • Producers of AutoReg® Silicon Chargers and AutoCal* Charger-Battery Combinations**

*Ⓡ *Trademark, C & D Batteries Div. The Electric Autolite Co.*
** *Trademark, Industrial Nucleonics Corp., Columbus, Ohio*

**For more facts circle 577 on Reply Card**

# WHAT'S JUST AHEAD IN THIS ISSUE

- DEPARTURE FROM the usual in scheduling engineering work in the plant engineering department is in effect at the Marietta, Georgia, plant operated by Lockheed Aircraft Corporation. Projects are spelled out on posted cards, permitting quick checks of progress by the various segments of engineering, i.e. civil, electrical, mechanical as well as the layout activity. For details please turn the page.

- WITH THE ever increasing use of radioisotopes in industry, a guide to their nature, applications, handling and disposal becomes a useful tool for the plant engineer. "Plant Engineers' Radioisotopes Primer," starting on page 116, makes no pretense of being a definitive textbook on the subject, but it will provide the basics from which the reader can progress to specifics.

- PARKING LOTS are now employing two new assistants—a pass card and ultrasonic equipment. The card lets you into the lot; the overhead ultrasonic detector closes the gate. This method is being used at Eastman Kodak to move cars into and out of their 15 parking lots. For the complete story, turn to page 122.

- LUBRICATION wasn't a problem at this plant until a furnace was redesigned to handle temperatures ranging from 900 to 2000 F. With this variation in temperatures, lubricant failures caused damage to the bearings, drive chains and sprockets. The article on how Olin Mathieson feel they have solved the problem—using a no-melt grease—appears on page 126.

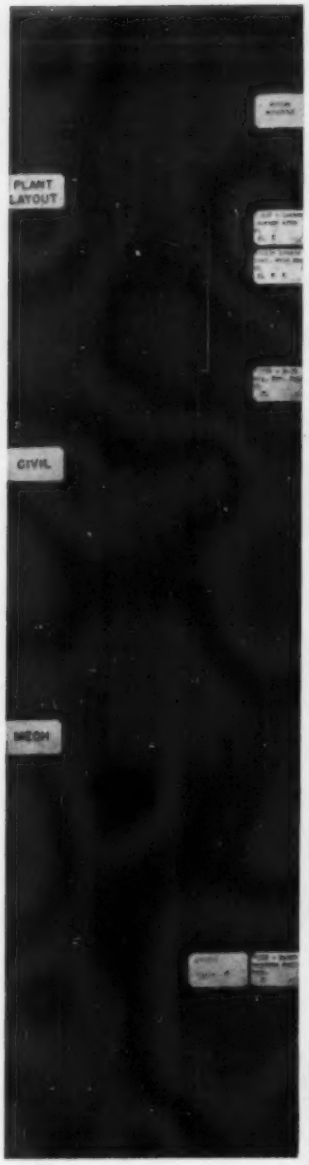
- ELECTRICAL DISTRIBUTION systems are frequently overlooked sources of cost reduction. Measurements of the system, its loads, and its capacity—with thermal meters—will enable you to adequately assess your system and keep it at optimum condition. The article starting on page 133 describes these meters and their application to power distribution analysis.

- ARE YOU grit-blasting different types of metal? If so, you will be interested in the special blasting room, equipped with easy-to-change grit supply, which the plant engineering department at Artisan Industries designed. The article on the "specials" designed into this blasting room starts on page 141.

- DECREASING THE cycling time of production machines often means an increase in profit for your company. Electric clutches that will engage and disengage in a fraction of a second, coupled with electrically-operated brakes, are proving themselves to be important elements in machine modernization. See how and why, in the article starting on page 143.

# HOW LOCKHEED'S PLANT ENGINEERING SCHEDULES ITS ENGINEERING WORK

By B. E. ALEXANDER, Maintenance Planner,
Lockheed Aircraft Corporation, Georgia Div., Marietta, Georgia




AT LOCKHEED Aircraft Corporation's Georgia Division, Plant Engineering schedules its engineering work—and with success. Formerly, the assignment of jobs was loosely controlled. Prediction of the completion date for the design of an item was useless prior to the actual start of the design work. Comprehensive analysis of the load situation in individual engineering groups or in the department was practically impossible. Jobs were occasionally "lost in the shuffle."

A system for graphically scheduling engineering jobs was developed to overcome these control problems. This system may be considered under the following headings: Basic Advantages; Solutions to Inherent Problems; Personnel Requirement; Equipment; and General.

**Basic Advantages.** Nearly all authorities on maintenance control advocate formal scheduling for maintenance construction work—the establishment of firm starting and estimated completion times for each affected craft. Such a schedule provides for a coordinated effort with millwrights, electricians, plumbers, etc., working in a definite sequence.

This same thinking must surely relate to engineering with layout, civil, structural, mechanical, and electrical groups involved. The first advantage is, therefore, a reduction in lost time with an elimination of rework. For example: the mechanical engineer must determine pump sizes, etc., before the electrical engineer can make his calculations for power requirements, wire sizes, etc.

Second advantage is the determination of a completion date for the complete engineering job. This projected date along with estimated material procurement spans and shop construction spans provides the basis for planning in new contract proposals or other situations requiring new or modified facilities. In the aircraft industry, delivery schedule is a most important consideration in bid proposals.

Third advantage is derived from the services of an engineer-planner who assigns and schedules the jobs. This man relieves the group supervisors of a major portion of their former workload—scheduling. The engineering group supervisors thereby have additional time to consult with subordinates in discussing and solving design problems. Their familiarity with work in process facilitates their appraisal and checkout of each job prior to its release.

Fourth and less tangible benefit of formal scheduling is the provision for better utilization of available hours. With jobs scheduled several weeks in advance, the engineer can use his time to advantage consistent with the master plan. For example, an engineer who is waiting for receipt of manufacturers specifications would begin work on his next scheduled job (not requiring prior work by another group), rather than on one selected at random.

**Solutions to Inherent Problems.** Engineering scheduling does present some problems. Perhaps the greatest of these is the engineer's natural resentment of regimentation. Because he is a professional man, any effort to supervise or monitor his activity too closely meets with resistance. This problem was surmounted by presenting to the engineers those factors which prompted development of the system. The engineer, with his analytical mind, can rationalize and accept scheduling when he is apprised of its advantages.

The basis for establishing any schedule is a knowledge of the time required for the particular job. The estimators in plant engineering had,

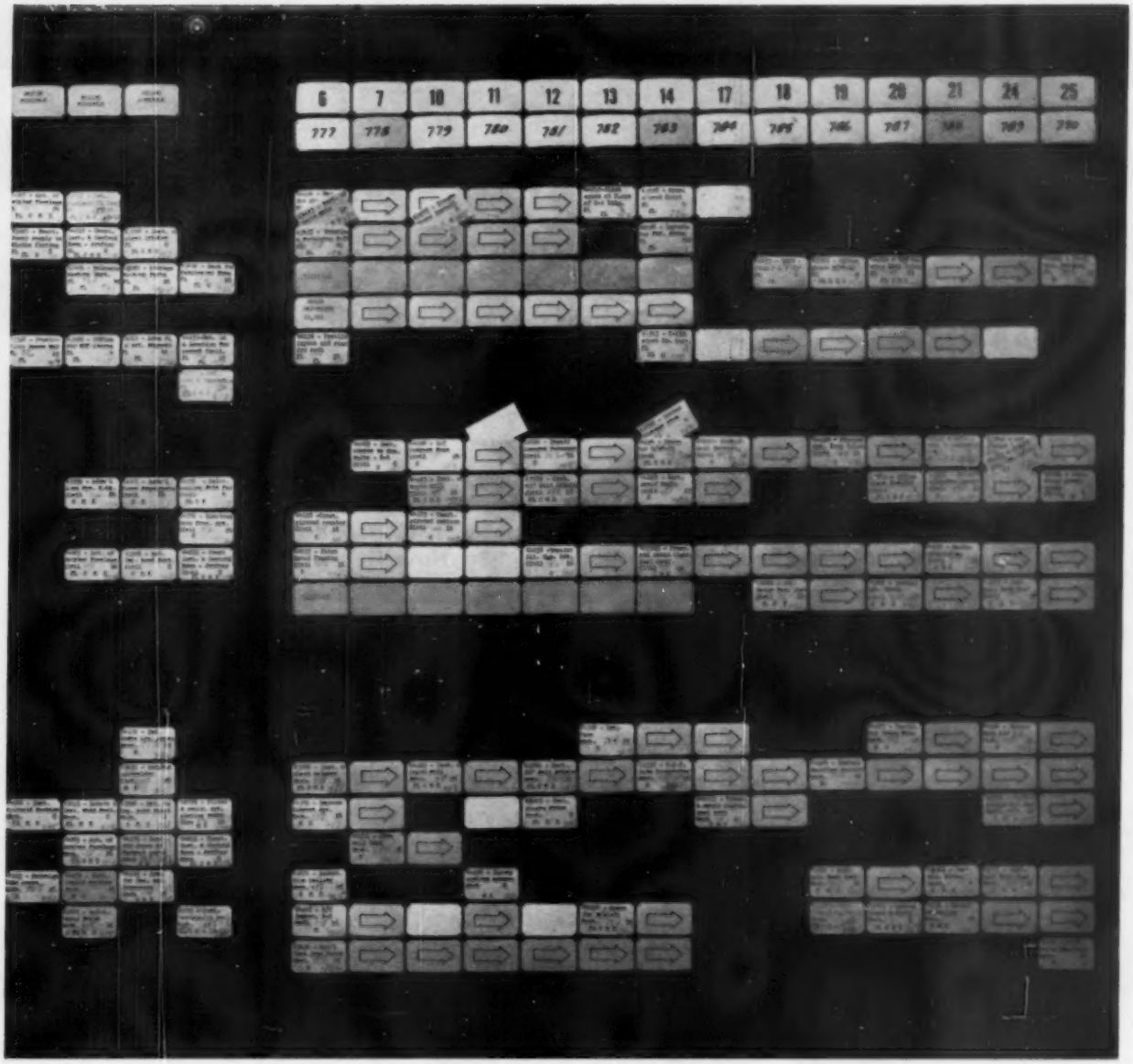



**Fig. 1. Portion of engineering scheduling board. Numbers at the top from 777 to 790 designate manufacturing calendar dates. Each card insert as well as each arrow stands for 8 man-hr. Initials on a card indicate work sequence.**

through experience, obtained a good working knowledge of the approximate hours required for design of any type of plant engineering job. This ability to estimate accurately is a vital part of the system. However, gross errors in estimating can be adjusted and the needed changes in schedule effected with the flexibility of graphic scheduling.

The ideal situation for scheduling would provide a group in which all personnel were equally versatile and proficient, a group in which the workload could be distributed evenly. Since such a group seldom exists, training must ultimately play an important role in the success of the system.

Coordination and cooperation among the engineering groups are two vital factors. Generally, the supervisor whose group is responsible for the major part of the design is responsible for coordinating the job through all affected groups; he becomes, in effect, a project engineer.

**Personnel Requirement.** The mechanics of the system require that a preliminary investigation of the job be made, along with an estimate of the engineering hours that will be required. This data then becomes the tool of the engineer-planner who schedules the job for engineers within the groups.

Engineers with building construction, mechanical, and electrical engineering backgrounds are employed as members of a separate staff group; one of the prime functions of this group is to investigate each job and estimate the amount of time that will be needed to design it.

A planner with an engineering background is employed to analyze, assign, and schedule all engineering

(Continued on page 248)

Plant Engineers'

# RADIOISOTOPES PRIMER

**What radioisotopes are ● What they do ● Future uses ● Detection instruments ● How to handle them safely ● What kind of equipment ● What type of ventilation ● What kind of construction ● Who should handle them ● How to get a license to use them ● How to set up a plant safety program**

By **F. J. REMICK**, Acting Director
Nuclear Reactor Facility
Pennsylvania State University

APPROXIMATELY 85 per cent of the largest manufacturing industries in this country employ radioisotope techniques. Radioisotopes offer reduced costs for maintenance, increased plant safety, simplified and improved quality control and reduced raw material and processing costs.

At present one of the greatest industrial uses of radioisotopes is in thickness and density control of products such as paper, metals, plastics and so on. In the paper industry for instance, radioisotopes are used as thickness gages to control basis weight as the paper is made and to control the thickness of coatings applied to the paper.

In refining and related businesses, radioisotope level gages have proved particularly helpful in controlling foaming and cooking operations, producing savings in downtime and maintenance costs.

The drug industry is using radioisotopes to carry out analytical procedures and tire manufacturers are using materials produced under the watchful eye of radioisotope gages.

One of the greatest potential uses will be the incorporation of low-level activities in process streams to automatically control the starting stopping, timing, etc. Other possible uses of radioisotopes would be as an aid in performing statistical tests for quality control, or for tagging components of a complex assembly so that their presence may later be verified. Tools might also be tagged so that they would not remain in undesirable locations.

Table I is condensed from a recent report on a census of industrial uses of radioisotope in this country during a 12-month period.

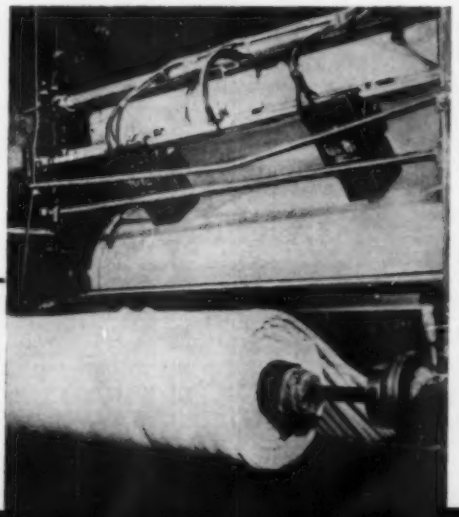
## What Radiation Is

The emission of radiation is a result of induced instability of the nucleus or orbiting electrons of the radioactive atoms. These atoms attempt to seek a more stable state by the emission of energy in the form of particulate radiation or electromagnetic radiation.

Some of the more common forms of particulate radiations are the alpha, the beta, the deuteron, the neutron, the proton, the meson, the electron, the positron and the neutrino. However, only several of these are of specific interest in industrial isotope utilization.

Electromagnetic radiation is a form of radiant energy having varying electric and magnetic fields. Its more common forms are radio waves, infrared heat radiation, visible light, X-radiation and gamma radiation. The latter two are of most interest in isotope application.

**Alpha Particles and Emitters.** An alpha particle deposits a relatively large amount of energy in a small area. Since it deposits its kinetic energy so readily, it travels only short distances in a material. For example a 7 Mev alpha particle will travel only about two inches in air and will not quite penetrate the outer dead layer of skin on an individual's hand. Alpha particles are readily detected by an ionization type of instrument such as a geiger counter, proportional counter or ionization chamber, if walls of the instrument are thin enough to allow alpha particles to



**Common application today of radioisotopes in industry is for density and thickness control. Here, rubber coating is so controlled by radioisotopes.**

**Estimated Annual Radioisotope Savings During a Twelve-Month Period in 1957-1958**

| Industry | Number of Companies Supplying Information | Gross Annual Investment in Equipment and Facilities | Net* Savings |
|---|---|---|---|
| Chemicals | 38 | $ 294,336 | $ 4,449,955 |
| Crude petroleum and gas | 20 | 70,248 | 820,350 |
| Drugs | 20 | 125,883 | 1,006,117 |
| Electric and gas companies | 4 | 5,076 | 12,351 |
| Electrical machinery | 16 | 124,804 | 294,036 |
| Electronic components and accessories | 19 | 55,845 | 819,605 |
| Engineering and architectural services | 57 | 553,519 | 2,147,362 |
| Fabricated metal products | 45 | 276,956 | 615,467 |
| Food and kindred products | 14 | 37,949 | 803,220 |
| Machinery (except electrical) | 26 | 65,283 | 994,938 |
| Metal mining | 4 | 13,368 | 265,451 |
| Miscellaneous | 1 | 740 | 360 |
| Paper and allied products | 93 | 369,056 | 2,813,319 |
| Petroleum refining and related industries | 32 | 295,360 | 11,671,158 |
| Plastics and synthetic resins | 30 | 119,264 | 1,385,022 |
| Primary metal industries | 85 | 427,799 | 2,238,617 |
| Rubber and miscellaneous | 26 | 288,327 | 2,841,064 |
| Stone, clay and glass | 20 | 206,830 | 874,742 |
| Textile mill products | 15 | 81,349 | 419,927 |
| Tobacco manufacturers | — | 49,500 | 2,905,822 |
| Transportation equipment | 30 | 285,324 | 1,729,533 |
| | | $3,746,816 | $39,108,416 |

*Difference between net annual investment and gross savings. Net annual investment is difference in cost of radioisotope equipment and equipment it replaced or would have replaced.

**Table 1. Magnitude of savings realized through use of radioisotopes is shown in table condensed from a recent U.S. report on census of industrial uses.**

enter the sensitive portion of the instrument.

**Beta Particles and Emitters.** The beta particle is a high energy electron. Specific ionization caused by an electron or beta particle is much less than an alpha. Since it therefore deposits less of its energy per centimeter of travel, it travels farther in material. Thus, where a 7 Mev alpha particle would travel two inches in air, a 7 Mev beta would travel more than 1000 in. The approximate maximum ranges of beta particles in various materials is shown in Table II.

From Table II it can be seen that beta particles can travel relatively large distances in tissue compared to alpha particles and therefore are a hazard to the body both internally and externally. On the other hand a small amount of shielding such as aluminum, lead, etc., is sufficient protection against the beta particles.

A typical beta emitter which receives much attention is Strontium 90, which chemically acts like calcium and thus accumulates in the bones where it will continue to emit damaging beta radiation to the surrounding tissue for the lifetime of the person in which it is accumulated. In the plant, such precautions as shields, gloves, aprons, lab coats, etc. can be used so that the radiological health problem from beta particles can be adequately controlled. Of course one must also protect against airborne or liquid ingestion of these materials as is the case with alpha emitters.

Beta emitting radioisotopes are of particular usefulness in industry for use as thickness and density gages. Because they can be easily shielded against they do not represent an appreciable hazard in the hands of those who have only a limited knowledge of radioisotope handling.

In addition, because they are easily stopped in materials, a small change in thickness or density of a material results in a readily detectable change in the number of betas passing through the material (assuming of course that the thickness of the material is less than the maximum range of the betas in the material). This detectable change in the number of betas passing through the material is utilized as a sensing unit for a servo-control system to adjust rolls, speed, coating thickness, or other variable parameters of the process being monitored and controlled.

**Gamma Rays and Emitters.** Gamma rays are a form of electromagnetic radiation and are normally of much higher energy than are X-rays.

They can penetrate matter quite readily, and therefore, present a serious shielding problem.

Because the gamma rays can pass through tissue they are a serious external radiological health problem.

Shielding procedures for gamma radiation are more involved than with alphas or betas. Heavy materials such as lead, bismuth, mercury, natural uranium, heavy density concrete such as barytes, are often used.

## Radiation Dose Units

The units utilized to describe the ionizing effect of radiation on materials are the roentgen, the rep, the rad, and the rem. Since the roentgen was originally defined for electromagnetic radiation and the rep was for particulate radiation, discrepancies have arisen. To solve this problem a new unit, the rad (radiation absorbed dose) has been adopted to substitute for the rep. The rad is a measure of energy absorption of any form of radiation (particulate or electromagnetic) in any material.

The factor which accounts for biological damage effect is the RBE (relative biological effectiveness). The product of the dose in rads (or reps) times the RBE is called the rem (roentgen equivalent man) and is the dose which is the final measure of biological injury to man.

In normal practice one works with radiation doses much smaller than a roentgen, and therefore, the more common units are milli-roentgen

**Table 2. Approximate maximum ranges in inches of Beta particles.**

| Material | Beta Energy (Mev) 0.5 | 1 | 2 | 3 | 4 |
|---|---|---|---|---|---|
| Air | 50.0 | 110.0 | 300.0 | 510.0 | 750.0 |
| Tissue | 0.062 | 0.15 | 0.37 | 0.65 | 1.0 |
| Aluminum | 0.023 | 0.06 | 0.15 | 0.25 | 0.34 |
| Lead | 0.005 | 0.012 | 0.032 | 0.055 | 0.08 |

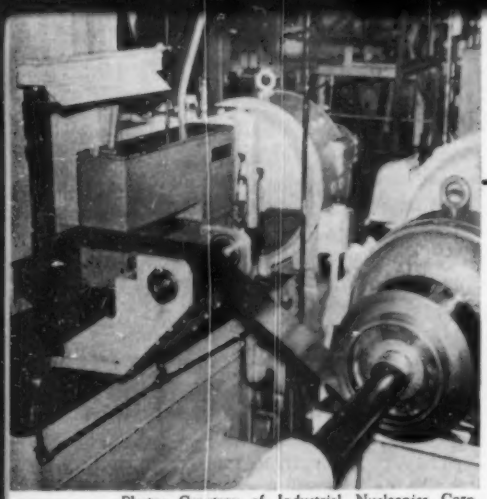


Photo: Courtesy of Industrial Nucleonics Corp.

**Radioisotope gage controls the thickness of brass strip as it is produced.**

## RADIOISOTOPES . . .

(mr), milli rep, etc. Also, since radiation survey instruments measure dose rates (usually in air) one should also become familiar with these units which are usually mr/hr or r/hr. This will enable the industrial worker to determine the relative hazards due to radioactivity used in the plant.

### Survey Instruments

Radiation survey instruments are normally categorized according to what ionization region they operate in. Each type of instrument has its particular field of applicability, but there is usually an overlapping of utilization.

**Ionization type** survey instruments are normally used where nominally high radiation fields exist. They can be calibrated directly into radiation dose units such as milli-roentgen per hour, etc. (mr/hr).

One must be careful, in detecting the low-energy betas or alphas with this type of detector, to provide either a thin window through which they can pass or to provide a means of getting the particles right in the detecting volume itself.

The most common ionization type survey instrument is the so-called "cutie pie" type, calibrated in mr/hr.

Other common ionization type instruments are the pocket dosimeter and the gold plated quartz fibre electroscope.

**Proportional type** detectors are utilized mostly to count alphas and betas. Because the size of the pulse is dependent on the ionization it is possible to distinguish between alphas in the presence of betas or to distinguish various low energy betas from one another by means of an external pulse height discriminator.

Typical proportional counters are the flow type counters with a means of introducing samples directly into the detecting chamber, fission counters and counters for detecting thermal neutrons, etc. End window flow counters and fast neutron detectors are proportional type detectors.

**Geiger-Mueller type** is one of the most familiar nuclear detectors. It is not dose sensitive, but only sensitive to the presence of radiation. This instrument can detect minute amounts of radiation and display the signal with inexpensive instruments.

The G-M counter is sensitive to gammas, betas and alphas but provision must be made (such as a thin window) if one is to count alphas or low energy betas since they would be normally absorbed in the gas chamber (G-M tube) walls. A G-M counter should not be used to measure doses from various energy particles.

### Handling "Hot" Materials

The type of radioactivity, the magnitude of the radiation from various sources and the physical form of the source, i.e. whether it is gaseous, powderous, a metal, etc. all are important parameters in determining the proper handling procedure to be used. In many industrial uses, radioactive materials will be used for tracers, thickness or level gages, etc. in which case the supplier normally will define certain safety procedures to follow. However, there will also be many cases, especially in industrial laboratories, when more information is required since each use can be unique in itself. For our discussion it will be assumed that the magnitude of the source strength is below a curie level, principally less than 10 millicuries if gamma emitters or high energy beta emitters are involved.

There is no substitute for the common sense approach to the handling of radioactive materials, and the suggestions offered here in the way of safety precautions, handling methods, apply to any area in a plant. If a radioactive sample is in the presence of plant personnel it should be adequately shielded for the type of radiation it emits. If the sample is an alpha or a low-energy beta emitter a metal can, well marked, may be adequate protection to all personnel in the area. Another sample emitting gamma rays or high energy betas will probably best be shielded in an iron, concrete or preferably lead vault or cave.

All radioactive samples should be well marked or tagged as to the physical form, emitting substance, type of emitted radiation, radiation intensity and at what distance away from the source the radiation dose rate is below tolerance.

In normal practice the radioactive sample or its unshielded container should not be handled directly with the hands but with leaded gloves, tweezers, tongs, etc. depending on the type and source strength of the sample.

All precautions should be taken in handling radioactive liquids, powders, gases, pellets, etc. in order that spills will not occur. Many times the use of plastic or metal containers or the use of double containers such as glass inside of plastic will be a worthwhile precaution to minimize spills due to breakage. Radioactive liquids either in their container or in beakers, test tubes, etc. should not normally be left unattended where someone might accidentally spill them, or as happens many times, be thrown away by janitorial help.

A spilled radioactive liquid or powder can be a real health hazard because of the ease with which it can be spread to other laboratories by physical contact or by air movement, the difficulty of its removal from ordinary building materials, and the extreme hazard of inhalation by personnel.

### Proper Health Practices

It should be remembered that fine powders, mists or fumes can diffuse through a room as readily as odors are diffused. Thus, fans, air conditioners, etc. should not be used indiscriminately without first considering their effect on recommended air flow or in spreading contamination to other portions of the plant in the event of an accidental spill or release of radioactivity.

Normally, all radioactive materials should be handled in adequately filtered fume hoods. Thus any fumes, dust or vapors which are released from the handling, working, pouring or altering of these materials will be drawn away from the personnel before they are inhaled or diffused throughout the laboratory or plant.

Smoking, drinking or eating in an area where unsealed samples are contained or are being worked on are extremely poor health practices and should not be allowed. Adequately calibrated survey meters sensitive to the type of radiation being handled should be readily available and constantly used in surveying for radiation dose rate levels and for the inspection of contamination of equipment or personnel.

## Equipment Requirements

The amount of equipment which is necessary is of course dependent on the scope of the work to be undertaken; however, there are a few basic items which are almost a necessity.

Any laboratory or plant in which radioactive materials are going to be handled in quantities greater than 10 micro-curies should have at least a Geiger-Mueller portable survey meter and an ionization type survey meter for dose rate measurements. If any radioactive samples are to be chemically or physically altered or if liquids and gases are to be handled, a continuously indicating air monitor should be used. Other special detectors such as neutron detectors, tritium monitors, flow type proportional counters, etc. will be dictated by specific needs depending on the samples being handled.

A fume hood is a valuable piece of equipment even if not to handle radioactive substances. An adequate supply of tweezers, handling tongs, absorbent blotting paper, lead bricks and radiation tongs and signs should be in easy reach. Radiation danger signs should be used only where necessary to prevent plant personnel from becoming so accustomed to the signs, that they ignore them.

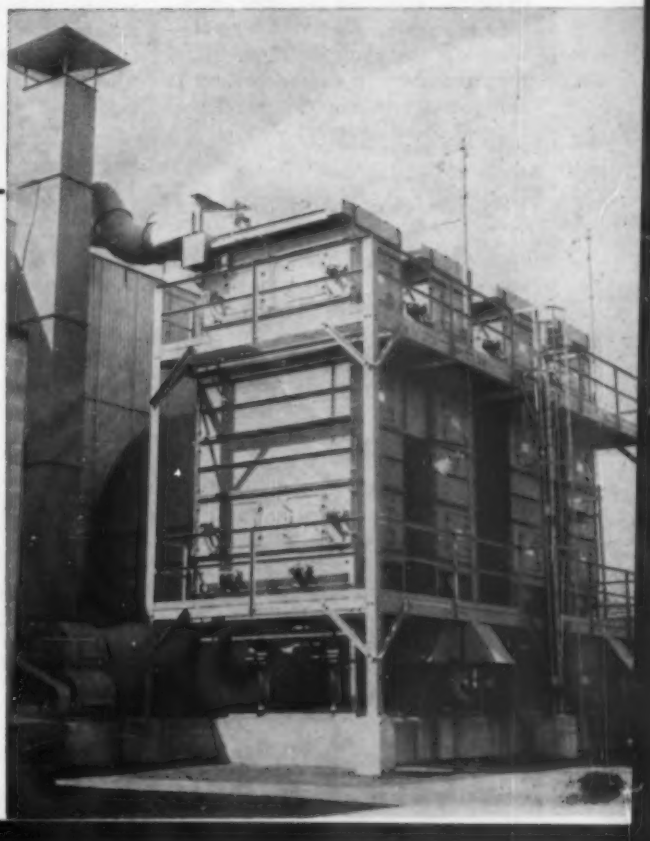
The use of glove boxes and other specialized equipment is dependent on the samples being handled. Radioactive materials should be handled as would be a material which was considered simultaneously to be toxic, irritating to the skin, corrosive and hot. With this in mind and by using common sense one should normally not have trouble in the routine handling of radioactive materials.

The location of the radioisotope laboratory is dependent on a large number of factors such as shielding necessary, location relative to other supporting facilities, access for shielded containers, and how readily liquid or gaseous wastes can be handled. For disposal or storage of liquid wastes a ground level laboratory might be advantageous while a top floor laboratory might be preferred for ease of gaseous discharge from fume hoods, etc.

## Structural Materials

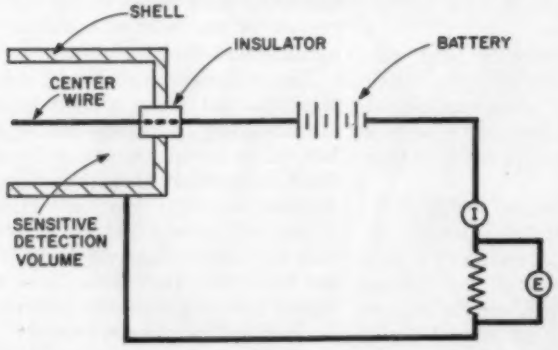
In general, the surfaces of structural materials in the laboratory or plant area involved, such as walls, floors, ceilings, benches, etc. should be smooth and non-porous for ease of decontamination. A minimum of miscellaneous pipes, offsets, cracks, shelves, etc. is recommended to aid in decontamination if it becomes necessary. Many highly washable paints such as the plastic variety are readily available for such use.

For floors, tight fitting linoleum or small vinyl tiles are acceptable since they can be replaced if they become contaminated. In no case should rough unfilled concrete be used where there is the danger of the spillage of radioactive liquids or dusts. A highly filled and waxed or well painted smooth concrete floor can be used, if necessary. Paints are available which



**Battery of dust collectors installed at nuclear engineering and development plant, reduce radioactive dust threat.**
Photo: Courtesy of American Air Filter Co., Inc.

**Schematic of a basic design nuclear detector. Details of how this type of detector operates, are discussed in text.**



will readily peel off for ease in decontamination. Where possible bench tops, fume hoods, sinks, etc. should be of stainless steel.

## Correct Ventilation a Must

One of the major considerations in the design of a good industrial radioisotope laboratory is that of ventilation. Although in many well designed and well operated radioisotope laboratories a completely separate ventilation system is not a necessity, the laboratory should never be a supply for air elsewhere in the building. That is, its exhausts should not go into a common air return to be recirculated.

The air should enter the laboratory in a smooth quiet manner in order that strong drafts do not occur which will readily pick up radioactive powder, etc. or interfere with air flows in the fume hoods, glove boxes, etc. The flow of air should be from the coldest portion of the laboratory (cold from a radiation standpoint) to the hottest portion of the laboratory where it should be exhausted. The reverse flow would contaminate the cold areas.

For this to be effective certain areas should be designated for use as cold or hot areas. The hot areas should be so located that they are not throughways for personnel from elsewhere in the plant or throughways for laboratory personnel going to storerooms, rest rooms, or other portions of the laboratory.

## Provide Protected Storage

Adequately shielded and ventilated space should be provided for the storage of radioactive samples used in the hot areas. Counting equipment should be located away from, or be well shielded, from the stray background radiation from these areas. Ventilating equipment in the laboratory should be so designed that all of it or portions of it, can be readily turned off from a central control in case of a spill which would require the evacuation of personnel.

In passing from relatively hot to cold areas protective clothing should either be changed or checked for contamination to prevent spreading it to other areas. Convenient locations for clothing storage and monitoring equipment at these areas should be supplied. Emergency showers for rapid decontamination of an individual are of great value.

The problem of waste disposal plagues all those in the nuclear industry. Although no real and complete answer yet exists for this problem on a large scale, there are several common sense procedures which work adequately for small volume or relatively cold wastes.

Ordinary solid wastes such as paper, wire, etc. should be placed in one type of container if they are uncontaminated and in another type of container which is adequately marked if they are radioactive, since the cost of handling the radioactive materials is many times that of the cold material.

## Contaminated Waste

There are several ways in which the contaminated bulk solid waste can be handled. There are commercial firms who offer the service of collecting radioactive garbage from industrial plants and research laboratories. This frequently is the most convenient way of getting rid of these wastes particularly in a crowded plant site. Other firms store the contaminated waste taking advantage of short half lives where they exist. Thus by a routine tagging of wastes as they are made and the routine inspection and monitoring at later times the cooled wastes are separated for normal disposal.

The long lived materials are either turned over to a commercial radioactive garbage collector or are shipped to the government for disposal at national sites operated by the Atomic Energy Commission.

Firms which generate large volumes of solid wastes normally install an incinerator for concentrating the wastes. However, these are expensive and must be operated under license from the AEC.

Liquid wastes present similar problems in an industrial radioisotope laboratory. In new laboratories a separate hot drain system and storage system is often built into the plumbing system. Thus all suspect liquid wastes are poured into this system. The hold-up tank is then monitored

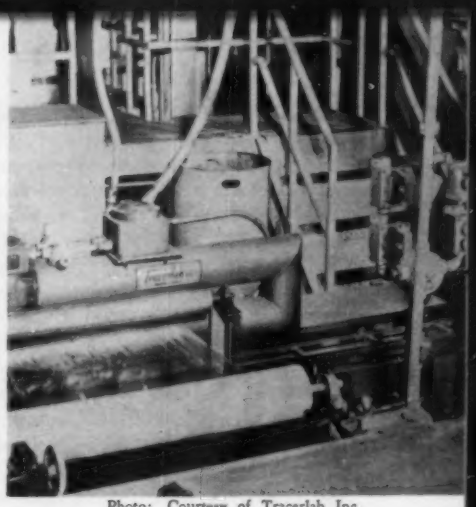


Photo: Courtesy of Tracerlab Inc.

**Even distribution of cellulose acetate adhesive coating is gained when application is monitored by radioisotopes.**

routinely. Uncontaminated wastes or wastes below disposal tolerance can be shunted to the sewerage system. Hot waste can be sent to a hot storage tank for eventual cooling if short half lives are involved or for concentration by various means with eventual disposal being accomplished by means of commercial firms or through the AEC.

Where a separate plumbing system is not feasible a separate polyethylene or stainless steel flask, bottle or tank can be utilized for temporary storage of the hot liquids. This entails further handling and costs with the increased danger of spillage or contamination of service personnel when it is removed.

The success of any plant safety program is dependent mostly on two factors. These are the individuals involved and the equipment utilized. Industry can best obtain plant safety through the proper selection of personnel. Emotionally unstable individuals should be weeded out, for the handling of radioisotopes takes not only a steady hand but also a level head. After selection, the personnel should be given access to the special courses in the field of radioisotope handling and use.

The equipment available for use is also important in any safety program. If radioactive materials are to be handled in any quantity or under unshielded conditions there should be an adequate supply of applicable survey meters, air monitors, etc. The presence of these instruments in itself is not adequate. They must be in excellent operating condition and must be used and interpreted properly.

If individuals are exposed to even minor radiation fields for extended

Photo: Courtesy of Industrial Nucleonics Corp.

**Nondestructive measurement of pipe wall thickness. Gage measures extent of corrosion, erosion or scale buildup.**

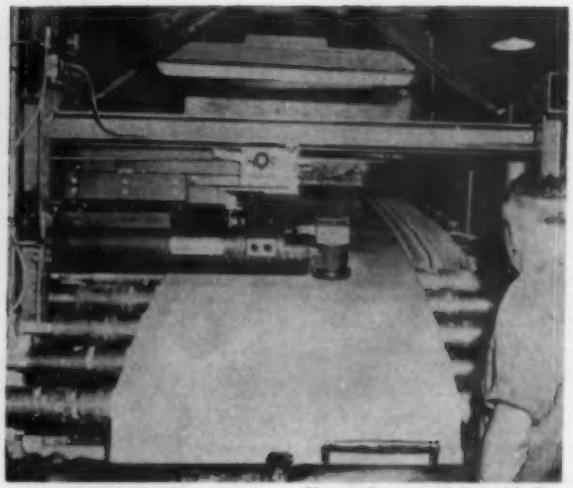


Photo: Courtesy of Tracerlab Inc.

**Paper industry utilizes radioisotopes for accurately measuring thickness of coatings applied to all types of paper.**

periods of time they should be supplied with appropriate integrating dose sensing monitors such as film badges. Film badges are small monitors worn on work clothing. They contain film packs sensitive to different types of radiation and are factors in determining the effect of radiation on the human body.

These badges also contain various filters which differentially absorb different energies or types of radiation so that when the films are developed and read for radiation exposure the types and energies of radiation can be identified.

For any industry using radioisotopes even if in shielded containers which are only seldom moved, it is highly recommended that samples be taken of dust (smear samples) in the immediate area to determine whether or not the sources are leaking. A routine sampling procedure should be set up either by the staff or by an independent commercial laboratory. Many suppliers of film badges, radioisotope equipment, etc. offer this service as a part of their business.

## Good Housekeeping

All radioactive sources of any consequence should be appropriately and noticeably tagged in a manner which cannot easily be destroyed or altered. A set of operating or handling procedures should be provided with any source particularly if handled by inexperienced personnel. Good housekeeping procedures are of vital importance wherever radioactive materials are used.

In the case of larger users it is recommended that some individual knowledgeable in the handling of radioisotopes be appointed as a radiological safety officer for the plant. He should enforce the regulations established by a safety committee. In the nuclear industry, there is no substitute for a well trained staff or for common sense, and a reasonable safety program set up and enforced by knowledgeable people.

## Licensing Regulations

In essence, anyone is entitled to a license to handle radioisotopes if the applicant's proposed equipment and facilities are adequate to protect the health and minimize the danger to life or property, and if the applicant is qualified to use the material.

The regulations of the AEC are published as a portion of the Federal Register as parts of Title 10, Code of Federal Regulations (CFR).

The government operates the largest facilities for the acquisition of radioisotopes. One can obtain catalog information from the AEC on the availability, cost and procedures in acquiring these radioisotopes for use.

There are also several commercial suppliers who purchase radioisotopes from the AEC and then fabricate the sources into the desired chemical or physical condition required by the eventual user. These commercial suppliers can be found in the usual industrial supplier directories which deal with the nuclear industry.

The third and rapidly growing source of supply for many types of radioisotopes is found in the industrial and university training, research, testing and power reactors. They offer the advantage in many cases of being closer to the user than, say Oak Ridge; and, for short half life radioisotopes this can be an important factor in selection of a supplier.

The use of radioisotopes in industry has already made history, but the total impact will only follow in the footsteps of an extensive educational program aimed at the scientist, the engineer and the technician.

During the past five years most of the educational institutions in the country have undertaken the responsibility of incorporating nuclear science and engineering courses in their curricula although in many schools these courses are directed more toward reactor design.

The Oak Ridge Institute of Nuclear Studies specializes in short courses in radioisotope techniques for industrial and university personnel. In addition, a few of the larger universities offer a variety of short summer courses directed toward radioisotope utilization in industry. **End**

### Radioisotopes Bibliography

**For a bibliography on the aspects of radioisotopes discussed in this article, write to the Editor, Plant Engineering, 308 East James St., Barrington, Ill., or write "Bibliography" on the post-paid card in this issue.**

Fig. 1. Car is about to enter one of the parking lots. The gate is down. Driver is getting ready to insert pass card (closeup is shown at left) in the slot.

**Pass lets you in, then ultrasonic sound waves take over to close gate... open exit side when you leave**

# *ULTRASONIC EQUIPMENT* MONITORS PARKING LOTS

SOUND WAVES are facilitating the parking of cars in the 45 acres of parking lots at the Kodak Park Works of Eastman Kodak Company, Rochester, N. Y.

The entrances and exits to the company's lots have been outfitted with 57 ultrasonic gates which, after insertion of a card key, raise to permit a car to pass through. The gates then automatically lower.

The parking card keys are inserted by motorists into slots in the base of the gate system. The slots are easily reached from the driver's seat.

Insertion of a card opens the gates. Then, as the car proceeds through, a high frequency sound wave beam is emitted earthward from an overhead arm.

An important element in the successful operation of the gates is the equipment which "senses" a car leaving the lot so that gates open and close automatically when required.

In the past, various means have been used to accomplish this, such as treadles and magnetic detectors installed in the entrance and exit lanes to parking lots. Recently, the Electronic Control Division of the General Railway Signal Company of Rochester developed the vehicle detector which offers outstanding advantages over other methods of gate actuation. The gate units are manufactured by Parking Corporation of America.

This detector senses vehicles by means of ultrasonic sound waves—that is, sound waves which are so high in frequency that they are completely inaudible to the ear. This system uses a sharply defined beam of sound waves, projected from an overhead detector unit, to sense the approach, presence and passage of a car.

By appropriate electronic means, the information obtained from the ultrasonic beam is used to control the gates so that the desired operation is obtained.

Unlike treadles and magnetic detectors, the sensing element of the detector is mounted overhead, above the pavement, where it is unaffected by flooding, wear, dirt, or corrosion, and where the maintenance of the sensing unit, if it is ever required,

**Fig. 2. As the car enters the lot, the overhead ultrasonic detector "reads" this and sets controls in motion which actuate the gate-lowering mechanism.**

can be handled without breaking pavement.

Although its operation is based on sound, the detector does not respond to extraneous noise, and is not disturbed by automobile exhaust sounds, brake squeals, or other acoustic disturbances.

The ultrasonic unit is a "presence" detector. It is aware of the presence of a vehicle in the detection zone at all times, regardless of the position of wheels, the size or shape of the vehicle, or whether it is in motion or standing still.

This characteristic makes it possible to use simplified gate control circuits, since no "relay memory" circuits are needed, as are required, for example, with treadle detectors.

An unusual and important characteristic of the ultrasonic detector is that it is immune to normal pedestrian traffic. Although the detector responds at once to the presence of a vehicle in the detection zone, the passage of a person through the same zone is ignored. This means that people can walk freely in and out of the parking area around the gate arms without causing improper operation.

The Kodak Park lots are principally a card-in, free-out parking area used by the employees. The ultrasonic sensing detector units are clearly visible above the driveway. These contain the transducers which generate outgoing ultrasonic waves and detect the incoming waves reflected from the pavement or a vehicle. The sensing heads contain no electronic tubes, and involve only inert elements, with long life expectancy. The associated electronic equipment is all assembled on a plug-connected chassis housed in a weatherproof case mounted on the same pole which supports the overhead detectors.

An employee wishing to enter a parking lot approaches the right-hand (entrance) gate, stops, and inserts his coded plastic card in the card receptor, visible just ahead and to the left of the entrance gate. This action causes the entrance gate to rise. The car then proceeds into the lot. When the car passes under the ultrasonic detector over the right-hand lane, its movement, clearing the gate, is sensed and the gate closes.

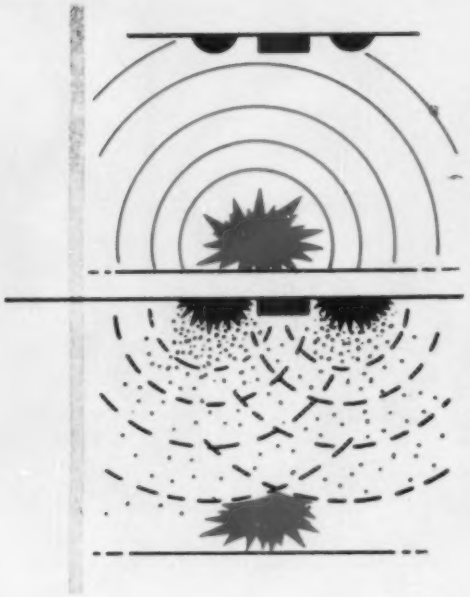
When a departing car nears the exit gate, the ultrasonic detector over the exit lane senses the approach of the vehicle and the gate rises. No action by the driver is required. When the car has cleared the exit gate, the detector on the street side of the gate detects this fact and the gate descends.

If a driver is leaving the yard and has reached the point where the mechanism has started to lower the gate behind him, another car following closely will reverse the mechanism by its presence under the gate-raising detector. In other words, the gate's closing behind the first car will not "catch" and dent the following car in the closing sequence.

A sound motion picture film on the use of the gate systems aided the company in introducing this new parking procedure to the employees. The 15 parking lots at Kodak Park hold some 6400 cards. **End**

**Fig. 3. When a car is ready to leave the parking lot, it approaches the exit lane. Detector senses car and raises gate; second detector lowers the gate.**

# EXPLOSION SUPPRESSION



**IN A FEW THOUSANDTHS OF A SECOND THIS EQUIPMENT HAS SNUFFED OUT AND RENDERED HARMLESS DIFFERENT TYPES OF INCIPIENT INDUSTRIAL EXPLOSIONS**

NEARLY EVERY process industry, such as chemical, petroleum refining, plastics, and milling, has an explosion hazard. Certain metallic dusts create an explosion problem in the metalworking industry. The potential exists in conventional thermal, as well as atomic, power plants. Wood flour and wood dusts are hazardous. Explosions are particularly destructive aboard ships, aircraft, missiles and their launchers, and military vehicles of all types. Table I lists some specific industrial hazards. It could be extended almost infinitely.

Now, engineers of Fenwal Incorporated, Ashland, Mass., have announced a system said to offer active, rather than passive, protection against accidental explosions. This explosion protection system detects an explosion at the instant of its inception, and acts within a few thousandths of a second to literally snuff out the blast before it can become destructive.

The system, developed in Great Britain, has been successfully applied to several installations in the United States, and has been proven, either in service or in tests, to be capable of handling most industrial explosion hazards.

The potential value of this protection system, which takes up where purely precautionary measures leave off, is shown by data compiled by the National Fire Protection Association. The NFPA records the following reported losses and their causes in 1958:

Explosions—Miscellaneous and Unclassified $25,178,000
Unknown and Undetermined Losses ..... 287,833,000
Total Losses During 1958 . 1,056,000,000

It seems safe to assume that explosions caused 10 per cent of the total, or about $100,000,000, since many of the losses from unknown causes were certainly explosively triggered. Indeed, some experts estimate that 40 per cent of the total loss results from explosions.

## How the System Works

System operation is based upon the fact that, although a blast appears instantaneous to the naked eye, there is a finite lapse in time between its ignition and the buildup of destructive pressures. The protection system acts within this period, which is measured in thousandths of a second. (The human eye cannot react to periods shorter than 0.1 second.) In a few milliseconds the system detects the very beginning of the explosion, either by sensing the initial pressure buildup or the first tiny flash of flame, and automatically reacts to snuff it out. The blast is made harmless by a combination of actions, which may include:

1. Suppression — envelopment of the explosion with a suppressant.
2. Venting—opening a path to the atmosphere for controlled relief of pressure.
3. Advance inerting — introducing

**Fire is one of the destructive results of an explosion. In 1958, it is estimated, actual losses direct or indirect, from explosions totaled nearly $100,000,000 in the United States.**

a suppressant into areas remote from the source of the explosion to prevent secondary explosions or fires.

4. Isolation—blocking the explosion from other areas.

5. Automatic plant or equipment shutdowns.

Figure 1 shows the basic suppression system and a graphical comparison of pressure buildup vs. time of a normal blast, and one which has been automatically suppressed.

Each explosion protection installation is unique, because it is tailored to meet the specific needs of the protected process of equipment. However, every installation consists of a combination of standard components. Systems can also be designed to protect against fire and explosion hazards by combination with standard extinguishing methods. Such combined systems usually provide considerable savings over separate systems.

Heart of the system is the explosion detector. Either a pressure or radiation device, the detector senses the incipient explosion and, in conjunction with a power unit, generates an electrical signal. Pressure detectors are sensitive to either the rate-of-pressure-rise or to a specific static pressure, or to both. A signal occurs when the pressure rise from the incipient blast exceeds either setting, indicating an explosive condition.

Radiation detectors are designed to selectively sense certain wave lengths of the spectrum which exist in an explosive flame but to reject others present in natural or artificial light, thus eliminating potential false alarms.

Upon receipt of a signal from a detector, the power unit, which is equipped with standby batteries for safeguard against power failure, delivers electrical energy to operate the various explosion protection devices in the system.

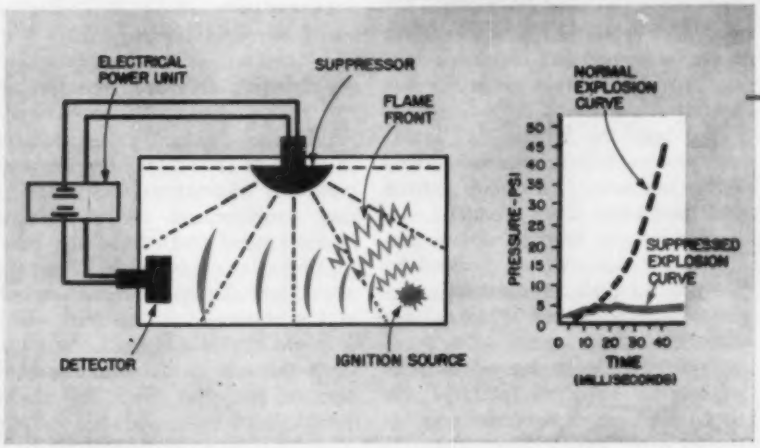
Protection devices may consist of suppressors, isolation valves or vents. All are operated by explosive detonators, similar to the precision electric blasting caps used in seismic exploration, for rapid actuation. It should be noted that the vents are not merely rupture discs blown out by the explosion itself but are opened before destructive explosion pressures occur. The time lapse between ignition of an incipient explosion and the operation of the various explosion protection devices is just a few thousandths of a second.

Suppressors may be easily ruptured hemispherical containers or high-rate discharge bottles. Both contain liquid suppressants. When activated, they dispense the liquid in fine particles moving at speeds up to 600 ft per second. The incipient explosion is cooled by heat of evaporation of the enveloping suppressant mist inhibiting further combustion. The most common suppressants used are water and bromochloromethane. As an example of the quantities of suppressants required, only 5 cc of water or 2 cc of bromochloromethane can suppress an incipient explosion in a one gallon volume.

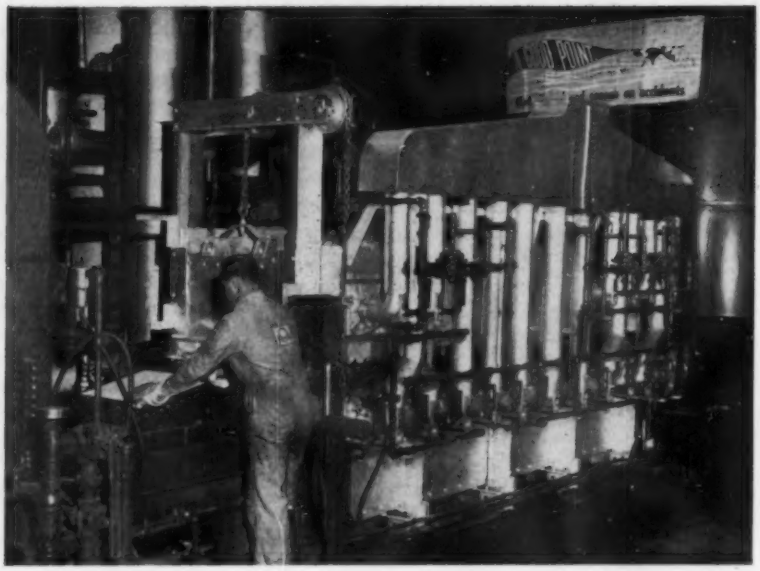
Essentially the vents are special glass windows which are fractured by an explosive detonator mounted against their outer face. Operation of the detonator fractures the glass, but the elevated pressure of the incipient explosion within insures that fragments will fly outwards, away from the protected space. **End**

| Industry | Hazards |
|---|---|
| Aircraft and missiles | Exotic fuels; fuel test cell facilities |
| Agricultural products | Grain mills; solvent extraction operations |
| Chemical processing | Complex hydrocarbons; plastics; insecticides; exotic fuels; ozonides; hydrogen peroxide; organic peroxides; and many others |
| Metalworking | Large scale painting and dipping; ovens and furnaces; paint drying; new metals such as sodium, titanium, zirconium, uranium, etc.; dusts of combustible metals; large boiler installations (common to many industries) |
| Paint and varnish | Synthetic resins and varnishes |
| Petroleum refining | Inherent hazard aggravated by new production techniques |
| Rubber | Hazardous monomers used in synthetic rubber and latex production |
| Petrochemical | Similar to chemical and petroleum refining and derived from both |
| Pharmaceutical | Solvent extraction in antibiotic production; complex molecule production |
| Pulp and paper | $ClO_2$ and $HO_2$ bleaching operations, wood flour milling |
| Power generation | Pulverized coal; boilers themselves |
| All industries | The human element |

Table above lists some of the common industrial, explosion hazards. There are, of course, many others.




Sketch at left illustrates basic suppression system. Detector senses incipient explosion and the agent is dispersed explosively. The agent extinguishes explosion flame by chemical action and cooling and also inerts the explosive mixture. Graph shows comparison between normal explosion curve and a suppressed curve.



Intermittent operation of this furnace—used for process development work—as well as the high operating temperatures caused seizure of roller-hearth roll shafts in their bearings.

# NO-MELT GREASE SOLVES BEARING PROBLEM

**Troubles were encountered when annealing furnace was used intermittently and at temperatures ranging from 900 to 2000 F**

By **Orville Madison,**
Superintendent of Maintenance,
Metals Div.,
Olin Mathieson Chemical Corp.

IN EVERY PLANT there are times when process equipment must be adapted to functions for which it had not been purchased or designed. At these times production and maintenance personnel are required to exercise their resourcefulness and ingenuity.

For process development work, our Metals Division at East Alton, Illinois, converted a controlled-atmosphere roller-hearth annealing furnace from continuous operation at approximately 1000 F, to intermittent operation at various temperature ranges from 900 to 2000 F. This furnace is used for heating ferrous and nonferrous alloys—quite a range in temperature requirements—and no small problem in furnace operating conditions.

We used the furnace to develop the process for manufacturing Roll Bond products. These are ferrous and nonferrous sheet products, containing integral tubes of various configurations and sizes as specified by the product designer, for heat transfer, refrigeration and structural applications.

Continuous operation of the furnace at the lower temperatures gave us no problem. But breakdowns began when we started to use the furnace for process development work. There were failures in bearings, drive chain and sprockets. On occasion, we have had to replace some of the heat-resistant alloy rolls.

The furnace is 15 ft long. Its roller-hearth is 24 in. wide. The hearth is made up of 54 heat-resistant alloy steel rolls, 2 in. in diameter. The rolls are mounted in cast iron bearings. They are driven by chain and sprockets. The roll bearings were packed with waste and lubricated by heavy cylinder oil. They worked perfectly in continuous furnace operation.

## Problems Experienced

At furnace operating temperatures in excess of 1800 F, roll bearing temperatures approximate 450 F. At such temperatures the roll shafts would expand and extend the bearings by as much as 1½ in. Then the heavy lubricating oil would run out of the bearings onto the shaft where it would oxidize and carbonize.

At the end of the run when the furnace was shut down, roll shafts would shrink back to normal size. In

To solve lubrication problem, waste packing was removed from the oil cups and the grease was packed in. The no-melt characteristic of this grease prevents bearing run-out.

To eliminate the weekly servicing we have installed spring-actuated grease cups on the bearings. These feed the lubricant automatically and, as a result, require little attention.

the process, carbonized deposits would be drawn back into the bearings where they would lock-in the shafts securely.

Starting up from a shutdown, roll shafts would not budge until furnace temperatures of 1000 F or higher had been reached. The hearth could not be operated at lower temperatures, as required for some alloys, until the furnace had been brought to 1000 F or higher to free the shafts.

Breakage of drive chain, sprockets and roll guides occurred on several occasions when we started the roller-hearth without preheating the furnace sufficiently.

We tried several types of heavy oils for the bearings—without any success. An automatic lubricating system was indicated, but this cost could not be properly justified for process development.

At this point we decided that bearing lubrication with heavy oil was not the solution. A heat-resistant grease was indicated. But the problem was how to apply it in oil cups. Most heat-resistant grease is stiff and could not be used.

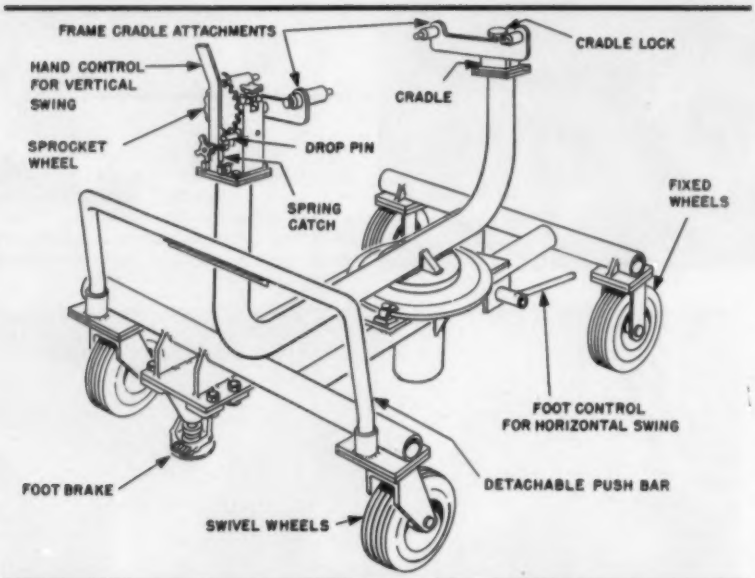
We looked into the microgel greases—since they do not have ingredients that would melt or dissolve at these high temperatures. Shell Darina Grease No. 2—with no-melt characteristics and stable oil and oxidation inhibitors—seemed to offer a solution to our furnace bearing lubrication problem.

So we removed waste packing from the oil cups and packed in the grease with a putty knife. To make sure the bearings were properly lubricated, we added grease twice a day at first. We found we were able to stretch out the lubrication period, and the grease was being added only twice a week.

Recently we installed spring-actuated grease cups on the bearings. These feed the lubricant automatically at a controlled rate with little or no attention.

The furnace has operated without breakdowns ever since we began to use this grease. Regardless of furnace temperature or intermittent operation, there is no run-out and carbonization of oil. Seizing of roll shafts has not occurred since. **End**

# CRADLE CART SIMPLIFIES ASSEMBLY




HANDLING OF heavy turbo machinery units along the assembly line, through runup and testing, and until the units are unloaded into their shipping container, has been greatly simplified at Garrett Corporation's Phoenix, Arizona Division of AiResearch Manufacturing Co. This simplification has been achieved by small, plant-engineered carts which permit universal positioning of the turbo unit during assembly.

After assembly, and with the unit still mounted in place, the carts are hooked together in trains and tractor-towed across an open space to the company's extensive turbine testing building. Here each cart is placed in an individual test cell and serves as a mounting for the turbo unit during runup and checkout. After testing, the carted units are towed either to the shipping department, or back to a finish assembly department where final customer-required modifications are made and then to the shipping department.

From the time of cart-mounting until the turbo unit is unloaded into its shipping container, these little handling carts provide the utmost in handling convenience and at relatively low cost.

Though several cart sizes are in use, all provide the same conveniences. A great number of different-type turbo units are handled on the same cart by simply modifying the fixture which attaches to the turbo unit, yet designing these fixtures so that they are universally attachable to the cart's frame cradle component.

All carts are rubber-tired to facilitate easy movement. Each is equipped with a toe-pedal brake which presses a friction pad firmly against the floor to hold the handling cart in any desired spot. This brake is mounted between the two castered front wheels; the rear wheels are rigidly attached to the cart frame.

Cart frames are of welded construction. Tubular structure members are used for added strength. The U-frame section in which the turbo unit is cradle-hung swivels horizontally. A foot control locks this horizontal swivel in any desired position. The vertically rotating cradle on the U-frame permits vertical rotation of the unit at will. Here again a ratchet mechanism permits locking the assembly unit in any desired position. The combination of horizontal swivel and vertically rotating cradle makes it possible to position the unit in the most convenient assembly aspect, then to lock it in an upright position for final testing.

In effect, these simple handling carts have solved all turbo unit handling problems at AiResearch from the time the unit gets too heavy for manual handling along the assembly line until it is unloaded in its shipping container and is ready for the customer. **End**

**Fig. 1. Left: Toe-operated pedal brake is located between the swiveled wheels, locks the cart in any position.**

**Fig. 2. Below: An assembler uses the vertically rotating ratchet crank to turn unit into convenient position.**

# HOW SANITATION IS ORGANIZED AT MARTIN

THE TASK OF maintaining clean, efficient plant surroundings is approached with the same orderly precision as the business of making missiles at the Martin Company's vast new Titan plant southwest of Denver.

In the four years it has been established, the Martin facility has become the largest single industry in Colorado with some 13,000 employees. It boasts a total of 22 buildings and structures having a total floor area of 1,292,000 sq ft. Of these, four buildings dominate the plant site on the upward slope of the Rocky Mountain foothills. These are the missile factory, with 365,000 sq ft of space; the administration building with 242,000 sq ft; the engineering building with 100,000 and the industrial relations building with 30,000.

To maintain orderliness in these gleaming, highly classified surroundings, Martin employs a maintenance sanitation department of 73 persons who are as skilled and dedicated to their jobs as the missile-making engineers and physicists are to theirs.

At the head of this staff is foreman Joseph Shanahan, who joined Martin two years ago after eight years as general foreman for the Ford Aircraft Co. in Chicago. Shanahan has more than 30 years of experience in the job of keeping industrial plants clean.

With him are five assistant foremen, three matrons and 64 other workers whose job requirements create what, to an outsider, seems a business appetite of fantastic proportions. This crew exhausts 48 mopheads in a month, 400 dust mops, a dozen 14-in. pushbrooms. It obtains and provides to washrooms and lavatories 50 cases of paper towels each month, 50 gallons of hand soap, 20 cases of tis-

Teamwork on the brooms is one example of tested procedures that spell outstanding efficiency at this plant.

# SANITATION AT MARTIN

sue. It applies and polishes an estimated 1650 gal of floor sealer-polish annually.

All this to Shanahan and his crew represents a big job, and then some. "You've got to look at it this way," says Shanahan: "It's a job, certainly. But in this kind of business, we figure that ours must be a job exceptionally well done, because of the product involved and because our crews help to determine the kind of environment the rest of the plant will have."

How, then, does the Martin maintenance program work?

The staff is divided about evenly from the standpoint of manpower over three shifts of eight and one-half hours each. The first, or day, shift is from 6:30 a.m. until 3 p.m. The second is from 4 p.m. until 12:30 a.m. The third is from 10 p.m. until 6:30 a.m. Personnel is assigned on the basis of seniority.

There are valid reasons for the one-hour gap from 3 until 4 p.m., and for the two and one-half hour overlap of the second and third shifts.

## He Gets There First

One of the maintenance department's key employees is the assistant foreman who reports for work at 3 p.m., one hour in advance of the second shift. He tours all buildings during this one-hour period. His job is to obtain reports on, or to note for himself any area where exceptionally high work activity during the day has produced a potential bottleneck. Thus he is in a position to take what steps are needed, when the second shift reports, to meet any unusual cleaning problem.

Because, with one exception, the second shift turns its attention to the I and R, factory and engineering buildings, there is no second-shift work performed at the administration building. The lone exception here is an employee who performs the same function for this building as the assistant foreman on the preceding shift does for the I and R, factory and engineering buildings. He checks stocks to replenish any that are in short supply, and to make ready for the arrival of the third shift at 10 p.m. The administration building is its sole responsibility.

Stock closets are maintained on each floor of every building for purposes of ready availability. It is the responsibility of each shift supervisor to determine in advance whether additional supplies may be required.

## Flexibility Important

The duties of the first shift are more general than those of the succeeding shifts, since it is during this period that the Martin plant is at peak activity and many cleaning tasks, if performed then, would create a diverting and congested environment.

Most first shift personnel operate on established traffic patterns in each of the major buildings, thereby assuring regular janitorial and maintenance service to each area, each office. The staff is sufficiently flexible, however, that individual men or groups of men are available to answer specific emergency requests provided the foreman by a Telautograph intercommunications system. These service requests are logged on paper with all pertinent data, including the time the request originated and the time it was fulfilled, as an efficiency measure.

Personnel assigned to the first shift includes three matrons, who service lavatories and replenish soap, towels and tissue. Two janitors care for executive offices, private dining rooms and two presentation rooms when they are not in use. Another has sole responsibility for Martin's reproduction department, source of all mimeograph and blueprint work for the plant. The remainder of the day staff is occupied with specific assignments developed to meet the demands of different buildings, areas and departments.

The biggest single chore is that of collecting and disposing of trash. Waste paper is collected in canvas baskets which are hauled to service doors at each building and emptied into waiting steel tubs. These tubs are lofted by fork lifts and hauled directly to a centrally located incinerator, where members of Martin's conservation staff are stationed to retrieve any solid materials which may be salvageable. After examination, the tubs are hoisted and their contents dumped into the incinerator.

Five fork lifts and two lug loaders, the latter equipped with lug containers which hold eight cubic yards of trash, are operated by the cleaning staff. The lug loaders are employed one each on the first two shifts, those of the heaviest workload and with the widest geographic distribution at the plant site. Three of the fork lifts are utilized during the first shift and one each on the last two. One of the fork lifts is employed on the second floor of the factory building, where the missiles are turned out. It ferries trash tubs to a freight elevator operating between the two floors.

An unusual problem at the Martin Company is disposal of large quantities of secret documents and notes which must not fall into unauthorized hands. For this purpose, only a few Martin employees are cleared to handle and dispose of this material. Clas-

sified papers destined for the incinerator first are folded and methodically ripped into small pieces, then deposited in special waste cans slotted at the top and secured by special combination locks. The combinations are changed at irregular intervals.

## Security Clearance

Janitor leaders—there are four of them—qualified by special security checks are the only individuals entrusted with the combinations. The cans are emptied into canvas bags at periodic intervals throughout the day shift. Because of their classified nature, the contents are never mixed with other waste paper collected from baskets elsewhere in the plant. Classified materials are hand carried directly to the incinerator and burned by the janitor leaders.

If trash collection and disposal is the largest chore at such a plant as Martin's, it is by no means the only one. Crews are constantly washing inside windows and window partitions. One man patrols the buildings to spot check the composition tile floors, replacing individual panels required. Vacuum crews clean carpeted executive offices and conference rooms after use. The organized pattern is such that in none of the buildings is there a prolonged suspension of cleaning activities.

Shanahan explains that this is a basic requirement of such staffs in large firms. Once the work load is allowed to get out of balance, there are untold difficulties in catching up. The only solution, Shanahan says, is not to allow the work to get out of balance.

The administration building is emptied of its big work force at staggered intervals starting at 3 p.m. At 4 p.m., the maintenance department's second shift arrives and starts its work in the factory, I and R and engineering buildings.

## Routes Prescribed

Crews requiring implements for their work pick up those items at storage rooms or other designated locations. Trash crews find canvas bags emptied by the preceding shift at the service doors of the respective buildings. These men follow a prescribed route in emptying every trash receptacle in each building, starting their pickup in the areas furthest from the service doors. One lug loader and one fork lift are available during the second shift to collect and deliver trash to the incinerator.

Sweeping crews move in next, also starting at the point furthest from the service doors. The purpose is to avoid congestion and tracking over freshly cleaned areas and to avoid time loss occasioned by a worker dropping or forgetting an implement en route from the storage room. Since he must work toward the storage room, the dropped item will be on his path. The system assures no backtracking, no time lost, no loss of an article.

Sweeping crews trailed by others with dust mops move through all but the administration building. Behind them is a crew equipped with wet mops and two 60-gal tank wagons halved with a clear water tank on one side and a wringer tank on the other. The floors next are dried and buffed with one of a dozen power buffers.

A power sweeper is used in the factory because of the wood block construction of the floors. The power sweeper clears only the aisles and open areas, leaving smaller areas to be cleaned manually.

Ceilings in the administration building and in other office areas at the Martin plant are of a corrugated plastic translucent material which must be cleaned constantly. Thousands of these lightweight panels are removed to be washed, dried and replaced nightly by a crew of four men operating a high speed portable wringer-type washing machine. Labor-saving machines are a necessity in such a large-volume operation.

Final job of the second shift is to clean, vacuum and dust each of the carpeted executive areas. These offices are located near the storage and equipment rooms and hence are the last to be cleaned. This keeps them free of dust or residue which might collect were they to be cleaned at the outset of the second shift.

Third shift takes over the administration building to repeat the cycle of emptying all trash receptacles, then sweeping, dusting and mopping. The ceiling panels are removed, washed and replaced and all interior glass is cleaned.

Because more people are occupied at this building than at any other, the administration building floor is subjected to greater wear and hence demands greater care. The floors are waxed at least once a month. Old wax is first stripped by the application of a special cleaner and the use of a buffing machine. Then two new coats of synthetic sealer are applied, one at a time, and polished with the buffer. About 1650 gal of sealer are consumed annually.

## Out, Damned Salt!

In winter months, this process may be repeated several times a month to remove harmful salt particles tracked in from icy sidewalks and to maintain the appearance and lifespan of the flooring.

This final job done, each member of the third shift crew cleans his equipment and returns it to its proper location, ready for use by the first shift when it reports for duty. The cycle is complete.

Twenty-six painters working 40-hour shifts each week are required to keep the buildings in trim. They apply an estimated 2500 gallons of paint annually. Outside window areas are cleaned by an independent contractor hired on a bid basis. **End**

**Above: Al Wilburn, left, is one of the few janitors qualified by security checks to know combination of locks.**

**Left: Classified material, now scrap paper, is deposited in one of the special cans provided for this purpose.**

# SIMPLE ALARM PROTECTS HEAT EXCHANGERS

By **WALTER JACOBY**, Maintenance Superintendent, S. P. D.,
I-T-E Circuit Breaker Company, Philadelphia, Pa.

DAMAGE to water cooled heat exchanging equipment can be prevented with this over-temperature warning circuit. In the past, we have experienced several costly failures in tube bundles on furnace atmosphere coolers, gas converters, evaporative coolers, and other similar water cooled devices. In the majority of cases, the cause of these failures was traced to an obstruction in the water line, insufficient water or failure to open the cooling water valves when starting the equipment.

If the operator had some warning of water temperature rise he could take corrective action before permanent damage to the tube bundle occurred. The circuit shown in Fig. 1 solved the problem of providing some warning of temperature rise, and Fig. 2 shows the alarm installed on a large elevator furnace in one of several heat-treating areas.

Schematic diagram, Fig. 1, shows the circuit in an energized or normal position. In this application, the alarm is protecting two tube bundles with water paths in parallel. TS-1 and TS-2 are normally closed temperature switches and their contacts open on a rise in temperature. The control relay coil, CR, and the safe pilot light, PL-1 are normally energized by a circuit completed through the normally closed temperature switches, TS-1 and TS-2.

If the water temperature in either tube bundle rises above a safe value for any reason, one or both of the TS switches will open, breaking the circuit to the control relay, CR, and the safe pilot light, PL-1. The normally closed, held open, contact CR-1 closes when relay CR is de-energized and sounds the alarm.

During the time it takes to locate the trouble, the operator can silence the alarm by turning the alarm cut-out switch, ACS, to the cut-out position. This opens the circuit to the alarm and closes a circuit to the red pilot light, PL-2, to show that the audible alarm has been cut off.

When the cause for the high water temperature has been corrected, TS-1 and TS-2 will close when the water temperature again drops to a safe value. This completes the circuit to the control relay CR and the green pilot light, PL-1.

Normally open relay contact, CR-2, closes, sounding the alarm again to remind the operator to return the alarm cut-out switch to the safe position. When this is done, the red pilot light, PL-2 goes out and the alarm is silenced. The green pilot light, PL-1, remains energized to indicate the alarm is set to warn of the next over-temperature emergency.

To provide maximum safety, the alarm is powered from an emergency lighting circuit. A power failure automatically starts the emergency generator to feed this alarm and other vital circuits such as the public address system, clocks and emergency lights.

Total cost of the alarm, installed, was $238.00. **End**

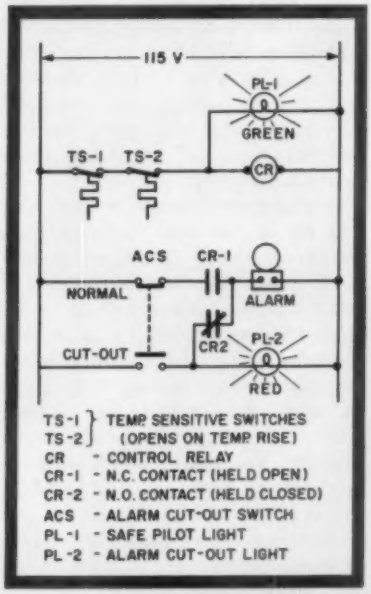



**Fig. 1. Above. When temperature rises, control relay drops out, green light goes off and alarm is sounded.**

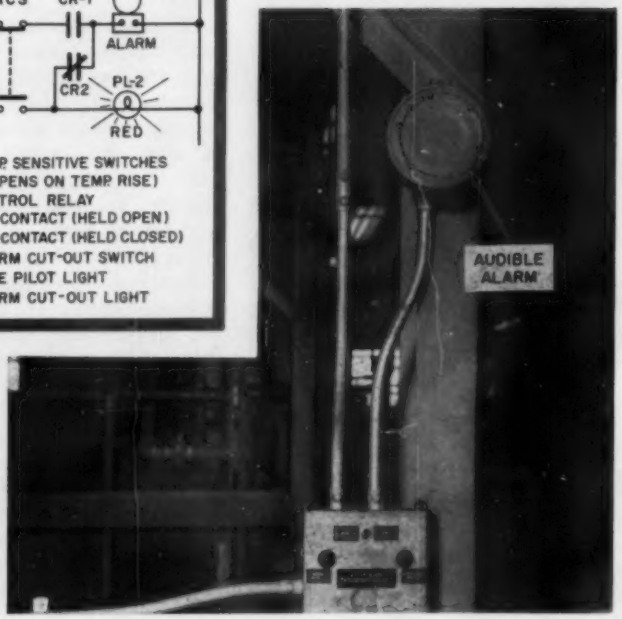



**Fig. 2. Right. Relay is mounted in box with pilot lights, switch on cover. Nameplates complete device.**

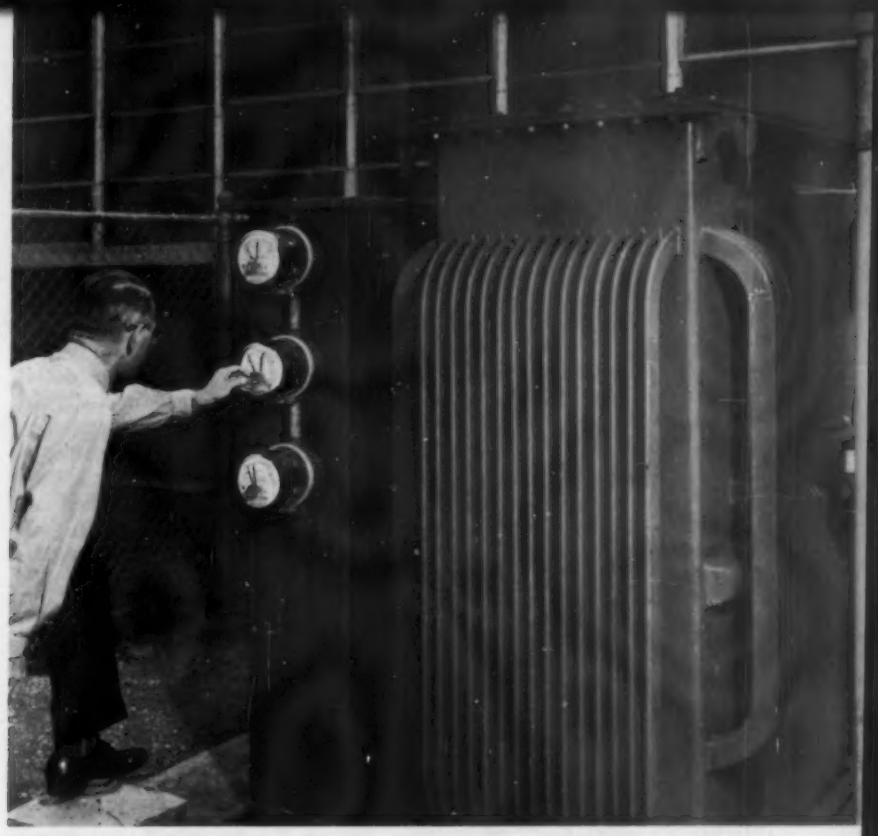


Fig. 1. Knowledge of operating characteristics of transformer bank supplying power loads is secured with two thermal ammeters, a thermal voltmeter.

# THERMAL METERING INSURES MAXIMUM ELECTRICAL EFFICIENCY

By **RICHARD WYETH**, Plant Engineer,
Sangamo Electric Co., Springfield, Illinois

PLANT ENGINEERS and engineering staffs charged with the responsibility for plant maintenance and construction are vitally concerned with the operating and design efficiency of the plant electrical distribution system. Over-emphasis on operating requirements such as continuity of service, means that plant capital investment will be excessive. On the other hand, inadequate system reliability results in production interruptions which can be just as costly.

Optimum electrical distribution system design, therefore, involves a fine balance between reliability and minimum investment. This balance can only be achieved through a complete knowledge of existing system operating characteristics, Fig. 1. From a design standpoint, the two most critical system characteristics are the thermal capacity of distribution system elements such as transformers and feeders, and voltage level at the load.

Inadequate distribution system thermal capacity means that loads must be reduced to prevent system interruption, or if undetected can result in costly shutdown and repair. Inadequate utilization voltage results in excessive heating and reduced output of motors, erratic operation of control devices, and inefficient operation of other electrical utilization apparatus. From the operating standpoint, this means lost production.

This discussion, is concerned with electrical measurements which will pro-

vide plant engineering and maintenance staffs with the information necessary for optimum distribution system design. Only measured facts are known facts, and these measured facts will enable the plant engineer to determine the "How much?", "Where?", and "When?", of plant distribution system investment.

It is obvious that the cost of measured facts must be reasonable in relation to the value of the information obtained. And this cost of measurement must include not only the initial investment in metering equipment, but also the cost of obtaining and utilizing the information. Experience has shown that the cost of obtaining measured facts is not significant in comparison with the potential cost savings to be realized from good distribution system design.

There are three basic types of electric meters applicable to industrial distribution systems. These are: (1) Mechanical integrating type meters, (2) Instantaneous indicating and recording meters, and (3) Time-lagged thermal response indicating and recording meters.

## Types of Meters

Mechanical integrating meters, such as watthour and varhour meters can be utilized for measurement of energy and demand. As the name implies, instantaneous responding meters provide essentially an immediate indication of change in the measured electrical quantity. This means that the meter will follow transient and sub-transient electrical disturbances in addition to relatively steady state load variations.

Instantaneous recording instruments do provide a complete history of instantaneous values over a period of time. However, a great amount of engineering time is required to interpret the charts and obtain integrated values. Indicating instantaneous instruments do not provide information on the range of variation of the electrical quantity and must be constantly read to be of value. From the standpoint of distribution system design, instantaneous responding meters have definite limitations and are relatively expensive.

The time-lagged thermal responding meter does not respond instantaneously to a change in the electrical quantity being measured, but responds to the rate of heating of that change. This means that transient and subtransient load variations are not reflected in the thermally lagged meter indication. Consequently, this meter gives an accurate indication of the thermal effect of load changes. Since cable, switches, switchgear, and transformers are all rated on the basis of thermal capacity, the thermal ammeter is an ideal instrument for providing measured facts necessary for the optimum design of system thermal capacity, Fig. 2.

Electrical distribution system design must consider utilization voltage level in addition to system thermal capacity. Both instantaneous and time-lagged thermal voltmeter measurements are necessary to achieve design objectives. Instantaneous voltmeters can indicate whether transient voltage dips are of sufficient magnitude to affect the operation of control equipment, and of other instantaneous voltage sensitive devices such as mercury vapor lighting. Time-lagged thermal voltage measurement indicates whether distribution system design is adequate to provide satisfactory operating levels under steady state conditions.

In addition to responding to the heating effect of the electrical quantity being measured, time-lagged thermal indicating ammeters and voltmeters can be provided with minimum and maximum idle pointers to retain the range of measured values until the meter has been read and reset. For the purposes of distribution system design, therefore, sufficient information can be obtained on voltage and ampere conditions without resorting to the more expensive recording type instrument.

Fig. 2. Curve shows the characteristic response of a thermal element meter.

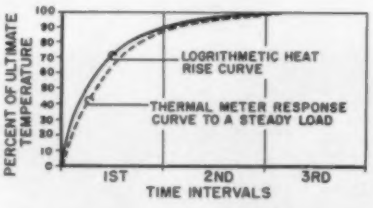
Fig. 3. Approximate cost ranges of instantaneous and thermal meters for checking amperes, volts and power.

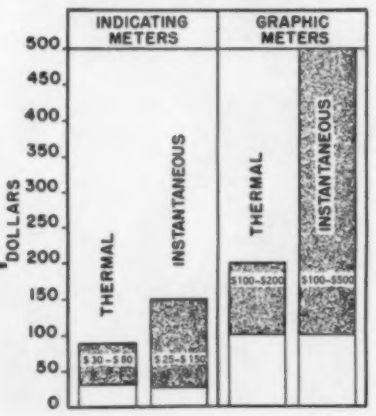
Simple and rugged construction of the thermal indicating meter also results in lower meter maintenance costs in comparison with these required for relatively delicate instantaneous instruments. The accuracy of instantaneous and time-lagged thermal meters is approximately the same, and are well within the limits required for effective system design. Figure 3 represents a comparison of the approximate cost ranges between instantaneous and thermal meters.

## Provides Design Data

As a result of a trend toward larger and more complex plant electrical distribution systems, progressive plant engineering and maintenance departments are reviewing and updating their electrical measurement practices. For many years the only types of distribution system instrumentation employed by industrial plants were instantaneous and mechanical integrating meters. Probably as a result of the limitations and high cost of installing and maintaining instantaneous type meters, many industrial plants preferred to over-design their distribution systems and not attempt to obtain optimum design through proper metering.

On the other hand, it is interesting to note that electric utilities have been depending upon time-lagged thermal metering for system planning infor-



mation for over 30 years. There is no explainable reason why plant engineering and maintenance departments should not have the same modern metering upon which to base their distribution system design as is current practice in the utility industry.

## Basic Principles

Basic principle upon which the thermal meter operates is the conversion of electrical energy into heat. Components used in the measuring element of the meter consist of non-inductive resistors (heaters), heat storage enclosures, matched bimetal coils, and when necessary, small current and potential transformers. These basic components and the above principle function within the thermal meter to measure electrical values by:

1. Converting heat into a heat difference
2. Converting a heat difference into a temperature difference
3. Converting a temperature difference into a pointer deflection.

A strip of bimetal, Fig. 4, that will bend when heat is applied, is wound into a coil with a shaft and pointer attached. When current flows through the heater, heat is produced proportional to $I^2R$. This causes an expansion of the bimetal coil and a pointer deflection proportional to $I^2$. This single bimetal coil would give an indication proportional to the square of the current, but unfortunately it would also respond to ambient temperature changes.

To eliminate the effect of ambient temperature, a second bimetal coil that has been carefully matched with the first is put on the shaft so as to turn in the opposite direction, Fig. 5. Now with a change in ambient temperature, one coil tends to move the pointer upscale and the second tends to move the pointer downscale. The result is that the pointer does not move with ambient temperature changes.

Each of these bimetal coils is contained within an enclosure and in the ammeter only one of the enclosures is heated. When current is passed through the meter, heat is developed in one enclosure causing the temperature to rise above that of the other enclosure. Responding to this difference in temperature, the bimetal coils produce a deflection of the pointer proportional to the square of the current. This results in a squared scale instrument.

A thermal voltmeter utilizes the same components and principles of operation as the ammeter except that the heater is connected across the line, Fig. 6, so that the current passing through it is proportional to line voltage. With the heater connected across the line, the voltage circulating through the heater develops heat within the enclosure proportional to $\frac{E^2}{R}$ causing the temperature of the enclosure to rise above that of the other. This temperature difference, through the bimetal coils, produces a deflection with change of voltage.

The time-lagged pointer response of thermal meters is a continuous logarithmetric average of the value being measured. It indicates 90 per cent of a change in the electrical value within the time interval of the meter. Thermal ammeters are usually designed with a 15 minute time interval but can have a time interval as long as 40 minutes.

Thermal voltmeters are designed with a 10 minute time interval to provide a quicker indication of voltage change. The time interval of a thermal meter is primarily determined by heat storage capacity and heat flow rate of the enclosure which surrounds the bimetal coils. Heat storage capacity of the enclosure depends on mass, specific heat of the material and upon the arrangement. Some of the factors which determine heat flow rate are: size, configuration, nature of surfaces and material.

Burden characteristics of transformer rated thermal ammeters and voltmeters are so small that even miniature instrument transformers are not overtaxed. The burden imposed is small enough that the meters can be connected on instrument transformers along with other electrical equipment such as relays without affecting the operation or accuracy of either the meter or the relay. For example, the burden of the current circuit of a three-wire indicating ammeter is only 2.5 V.A.

## Thermal Capacity

Without a knowledge of the present thermal load on all parts of the electrical distribution system in relation to existing thermal capacity, intelligent planning for the addition or relocation of electrical load is practically impossible. Thermal loading of electrical distribution equipment such as transformers and feeders can be effectively determined when the ampere load on these system elements is continuously monitored with thermal ammeters.

Generally, plant distribution system thermal capacity will be limited either by transformer or feeder capacity. We will first consider transformer monitoring with thermal am-

Fig. 4. A thermal meter using a single coil is affected by temperature.

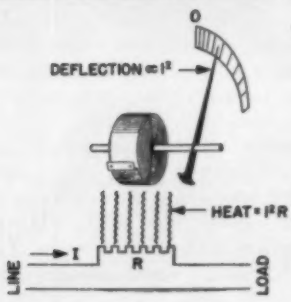



Fig. 5. Oppositely mounted retarding coil offsets effect of temperature.

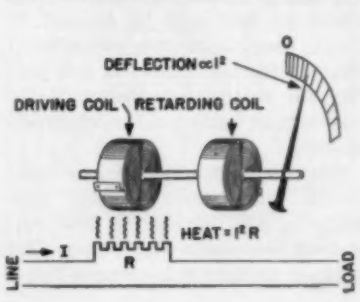



Fig. 6. Thermal voltmeter heater is wired across circuit to be measured.

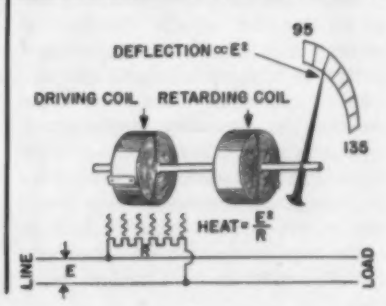


Fig. 7. Lowest cost approach to obtaining continuous record of transformer loading is by use of indicating thermal meters.

Fig. 8. Including indicating thermal ammeters in substations insures readily available data on substation after installation.

## THERMAL METERING – MAXIMUM EFFICIENCY

meters, and then discuss individual feeder measurements.

An industrial plant electrical load is very seldom static. The trend toward automation of production processes results in the continual addition of electrical load. At the same time, development of new products and processes obsoletes existing operations and either removes the existing electrical load or replaces it with a different one. As a result, thermal loading on transformers and feeders is constantly changing so that information obtained a year ago or even a month ago can be completely misleading. The lowest cost approach to obtaining a continuous up-to-date record of transformer thermal loading is through the use of indicating type thermal ammeters as a permanent installation on all distribution transformer banks, Fig. 7.

### Substation Metering

Where new package substations are to be installed on the distribution system, the most satisfactory approach to insuring adequate thermal loading data after installation is to include the necessary switchboard type indicating thermal ammeters in the original substation package, Fig. 8. Since it is common industrial practice at the present time to include either a primary or main secondary circuit breaker in each package substation, the necessary instrument transformers are available. In this case, three switchboard type indicating thermal ammeters with minimum and maximum idle pointer can be included for approximately $80.

Since the typical industrial packaged substation with a 15 kv nominal primary and 480 volt nominal secondary costs between $15 and $20 per kva installed, it is only necessary to save four kva of transformer capacity to pay for this metering installation. The necessary thermal indicating ammeters for switchboard mounting can be either individual units for each phase, or triplex meters can be applied in either horizontal or vertical mounting. If it is also desirable to have instantaneous indicating ammeter readings in addition to the thermal ammeter for immediate information when closing in a circuit, combination units that provide both indications are available, Fig. 9.

Where it is known that the new substation load will be cyclical in nature, then graphic-type switchboard mounted thermal ammeters will provide the information necessary for maximum utilization of the substation capacity.

On existing transformer and substation installations, socket type mounting will provide the most economical permanent installation. One common practice is to connect two 5 terminal meter sockets per phase at each transformer in such a manner that socket type thermal ammeters, voltmeters, kw, kva, and kvar meters can be plugged into the sockets, Fig. 10.

Normally, three ammeters and a single voltmeter are permanently installed. If, in this installation, one or more of the indicating ammeters shows an abnormal condition, socket type graphic thermal ammeters can be plugged into the sockets to obtain complete information on the nature of the disturbance.

### Graphic Meters

Socket type indicating ammeters used here are designed for operation from instrument transformers, and provide a self-contained saturable current transformer making additional meter protection unnecessary. Here, also, combination instantaneous and time-lagged indications can be provided. Socket type thermal ammeters are available with multiple ranges to provide maximum accuracy under light load conditions.

Graphic thermal ammeters are available with 2, 8, 16 and 32 day chart drives which are readily interchangeable in the field, Fig. 11. Where it is desirable to keep the chart running during power outages, ther-

mal graphic meters can be provided with electrically wound chart drive with spring carryover. This feature makes it possible to determine the duration of a particular power outage.

On existing transformer banks employing three single-phase units connected in four wire wye, thermal ammeters can be provided in each phase without instrument transformers. Self-contained thermal ammeters in capacities up to 500 amperes are available for installation between the neutral and the primary lead of the transformer. The necessary meters for such an installation cost approximately $40, Fig. 12.

Whereas thermal loading of transformers is of paramount importance, both voltage drop and thermal loading must be given equal consideration in the case of individual distribution feeders. As in the case of transformers, thermal capacity can best be ascertained by means of thermal ammeter measurements at the substation. The cost of permamently metering individual feeders below 600 volts generally cannot be justified except where a few critical feeders are involved.

A practical low cost approach to obtaining the necessary information is to employ a portable thermal ammeter assembly with split-core type current transformers, Fig. 13. This assembly consists of three sockets prewired to the instrument transformers, in which can be mounted indicating or graphic type thermal ammeters. Where a chart record on 600-v feeders is always required, this can be obtained most simply through the use of portable graphic meters with split-core current transformers.

Primary distribution feeders in the 5 kv or 15 kv class are generally sufficiently important to justify individual metering. In modern industrial primary substations where metal clad draw-out type air circuit breakers are used on individual 5 kv and 15 kv feeders, current transformers are available for thermal ammeter connection.

## Primary Metering

Here again the most desirable approach to obtaining the necessary loading information is to include switchboard type indicating or graphic ammeters in the original installation. The most practical and economical approach is to include combination indicating, instantaneous and thermal ammeters on each high voltage feeder, and to employ graphic instruments only where abnormal conditions are experienced. A less satisfactory but more economical approach is to use three combination thermal and instantaneous ammeters on each feeder with a transfer switch to transfer the meters from one feeder to another.

On critical high voltage feeders supplying cyclical loads such as electric furnaces, a recording type instrument will be necessary to provide a true picture of the thermal loading on the feeder. Since a chart of this type is often desirable from an operating standpoint, the cost of permanently installing graphic type thermal ammeters can usually be justified for such applications.

In older plants and on less critical feeders where individual circuit breakers and instrument transformers are not available on individual feeders, an economical installation can be obtained through the use of split-core current transformers and socket type meter installations. This type of installation can be made permanent, or can be arranged as a portable assembly for periodic survey of all such feeders without permanent metering installations.

This has been a brief description of a few of the many possible installations for obtaining the necessary metered information on thermal loading of the plant electrical distribution system. Installation requirements and economics will, of course, vary with the individual plant distribution system; however, every plant engineer must have this information if he is to effectively perform his function of providing maximum system reliability at minimum investment.

One of the basic problems of plant distribution system design and operation is the maintenance of utilization voltage levels within acceptable limits at all times. Continuous knowledge of voltage conditions at principal points on the distribution system is necessary if proper load voltage regulation is to be maintained.

## Voltage Measurements

Both instantaneous and time-lagged thermal voltmeter measurements are necessary to achieve design and operating objectives, Fig. 14. Instantaneous voltmeters can indicate whether transient voltage dips are of sufficient magnitude to affect the operation of control equipment and other instantaneous voltage sensitive devices. Voltage dips of this nature on industrial distribution systems are usually caused by the start up of large motors or sudden application of other major loads.

The time-lagged principle of voltage measurement averages voltage variations over a period of time, so that transient and sub-transient effects are not reflected in the meter indication. Thermal voltmeters, therefore, offer an economical method for obtaining reliable data on minimum and maximum average voltage levels. This information indicates whether distribution system design is adequate from the standpoint of voltage drop and load voltage regulation.

Thermal indicating voltmeters are equipped with maximum and minimum pointers and can be provided

Fig. 9. Combination meter provides both thermal and instantaneous indications.

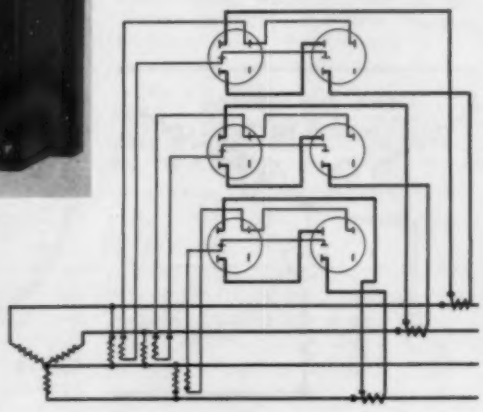


Fig. 10. How to wire meters to measure amperes, volts, watts or vars in a three phase system.

with an electromagnetic clutch between the moving shaft and pointer so that minimum voltage reading is not lost in the event of a power interruption. An ideal variation of this instrument for indicating substation bus voltage is the combination instantaneous and time-lagged voltmeter. This voltmeter provides all of the information necessary for the design of adequate load voltage regulations on new feeders added to the substation, or for load changes and additions on existing feeders. If the minimum and maximum pointers on the lagged thermal voltmeter indicate an abnormal condition, portable recording voltmeters can be connected to give time of occurrence for establishing the cause.

Voltage measurement on the distribution system should begin at the utility service entrance. This provides operating and engineering personnel with information as to voltage regulation at the service entrance. Either an indicating or graphic thermally-lagged voltmeter can be used for this purpose.

Both instantaneous and thermally lagged voltage measurements should be made on each substation bus throughout the plant. This provides a design reference point for voltage drop calculation when changes are made to the system. As in the case of ampere measurement, the simplest and least expensive approach to obtaining this data is to include switchboard mounted, combination instantaneous and thermal meters in each package substation when originally purchased. Three combination voltmeters should be provided on all substations with high voltage secondaries. This is also desirable in the case of load center substations with 480-v secondaries. A more economical but considerably less desirable approach to 480-v bus voltage measurement is the use of a single combination voltmeter with transfer switch.

## Monitoring Feeders

It is good distribution system operating practice to read the minimum and maximum voltage levels at each substation bus once each week. For the more critical main substations, this reading should be made daily, Fig. 15. In this manner, unusual voltage conditions can be detected before severe damage or a costly shutdown is incurred. Low secondary voltage on substations primarily supplying motor loads are particularly critical to sustained low voltages. If such a condition is undetected for an extended period of time, motor overloads and subsequent burnouts will result.

High voltage motor control centers are another critical point where combination instantaneous and thermal voltmeter information is extremely important. The thermal indication of minimum voltage level will provide the information necessary to determine that adequate "steady state" voltage conditions are available for such important drives. The instantaneous voltage indication provides the information necessary to determine whether circuit conditions are adequate under motor starting conditions.

Periodic monitoring of feeder voltage levels with a portable thermal graphic voltmeter, Fig. 16, can assist the maintenance engineer in determining where abnormal voltage drops are being introduced into the system. This type of spot checking can often point out faulty bus connections or poor plug-in bus duct connections before they are subjected to excessive heating and permanent damage.

The thermal voltmeter is an important and inexpensive tool which can provide essential data on voltage levels throughout the distribution system. This instrument in conjunction with the thermal ammeter can provide the design engineer with the major

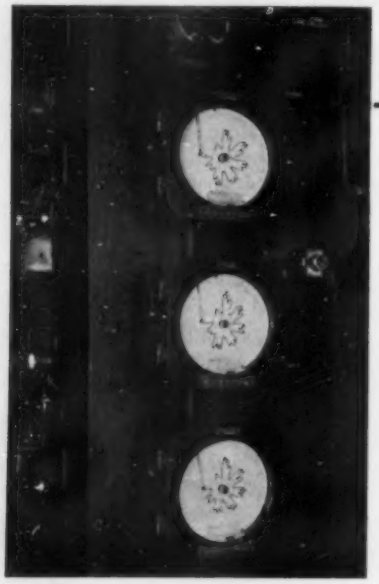


Fig. 11. Three graphic thermal ammeters draw chart of 4 kv bus load.

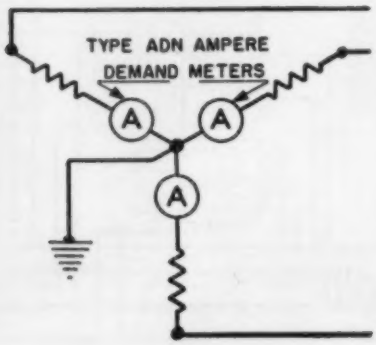



Fig. 12. No instrument transformers required with self-contained meters.

Fig. 13. Split-core current transformers simplify meter installation.

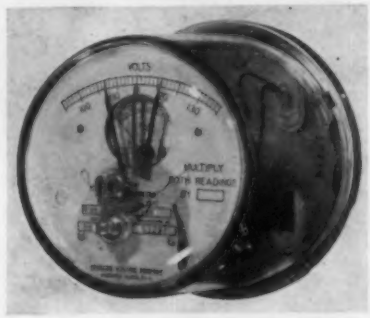


Fig. 14. Thermal voltmeters can have both thermal and instantaneous dials.

Fig. 15. Good operating procedure, read bus voltage levels once a week.

Fig. 16. Portable graphic thermal meter can be used on 120 or 240 volts.

elements of information necessary for intelligent planning of electrical load additions and changes. They can provide the maintenance engineer with information on abnormal conditions sufficiently early to take preventative action before costly shutdown and repairs are incurred.

We previously stated that the basic circuitry of the thermal averaged ammeter could be applied to measure kilowatts (kw), kilovolt amperes reactive (kvar), and kilovolt amperes (kva), Fig. 17. Before discussing the application of thermal power meters, a brief explanation of their principles of operation will be given.

Basic circuit for a kw thermal meter is shown in Fig. 18. A small potential transformer in the meter has its primary connected across the line and its secondary connected in series with two non-inductive heaters of equal resistance, one of which is associated with each enclosure. When both current and voltage are applied, a circulating current that is proportional to the line voltage passes through the heaters. A second component of current proportional to the line current is introduced through the mid-tap in the potential transformer secondary and divides so that one half flows through each heater.

Note that the components of current add in the rear heater but subtract in the front heater. Because temperature rise in each enclosure is proportional to the heat input, the temperature difference between the two enclosures will correspond to the difference between the two values of heat input, or simply watts. This temperature difference of the bimetal coils produces a deflection of the pointer on the kw scale.

The above principle of the thermal kw meter can be applied to the measurement of all single-phase and polyphase circuits. While the circuit of the two-wire thermal kw meter has only one heater associated with each bimetal coil, in polyphase meters 2, 3, 4, or 6 heaters are utilized. Since any polyphase circuit consists of two or more two-wire single-phase circuits, the heat inputs of the two-wire circuits can be added together and the resultant temperature difference measured with one pair of bimetal coils.

## Measuring KVAR

Thermal meters to measure kvar only require that the voltage be shifted 90 degrees lag. An external reactiformer can be applied with a thermal kw meter to obtain kvar values. However, thermal kvar meters are available with the phase shifting done within the meter. These meters are provided with a selector switch receptacle and a two-position plug which provides two tap positions. The 90 degrees position is for kvar measurement and the 0 degree is for unity power factor or watt demand measurement.

Unity position is provided for convenience in testing since with the plug in this position the meter may be calibrated as a kw meter. After the meter is calibrated for watts it is only necessary to move the switch plug to the kvar position to measure kvar demand. With the plug in this position, voltages lagged 90 electrical degrees from line voltages are supplied to the heater circuits, and through the heaters and bimetal coils kvar demand measurement results.

Thermal kva meters also utilize the same basic components and principles of operation as the kw thermal meter except that kva measurement is accomplished by a phase shifting principle. The meter potential is shifted internally by means of a selector switch which interconnects the potential coils, Fig. 19.

The selector switch consists of a receptacle to which all taps from the potential coils of the meter are permanently connected, and a set of plugs to select various angles of power factor. One plug is used for either 71 or 87 per cent power factor taps. Another plug is for unity power factor so that the meter can be connected as a kw meter for convenience in testing.

In today's complex industrial plant, power measurements can help the plant engineer solve his everyday operating problems and also realize important economies in planning and maintaining the electrical system. Thermally averaged meters for the measurement of watts, vars, and kva are ideal for use by industrial plants because of the fact that their response

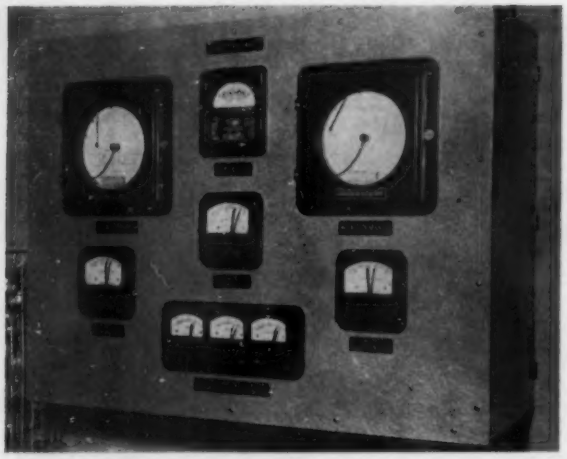


Fig. 17. Thermal kw and kvar graphic meters provide power and energy data on this industrial 500-kva feeder.

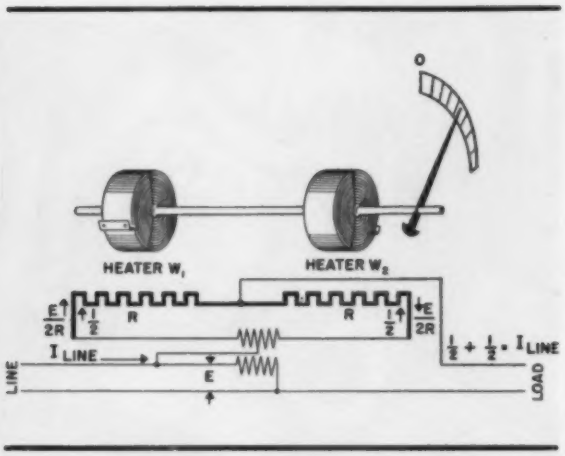



Fig. 18. Schematic of thermal meter designed to measure watts. Heat is proportional to voltage and current.

## THERMAL METERING – MAXIMUM EFFICIENCY

corresponds to the actual heating effect of the load and also because they are relatively inexpensive.

Thermal meters for measurement of watts, vars, and kva are available in both indicating and graphic types. The indicating meters can be furnished with two idle pointers to record both the minimum and maximum average values. Most industrial plants have found that the socket type indicating meters are the most economical and are the easiest to install.

Many forms of power measurements are useful to the plant engineer. For example, power meters can be used on the incoming utility service to check total plant load conditions, Fig. 20. This is particularly important where continuous load control is necessary to minimize demand billing charges. Active and reactive power measuring meters are invaluable for the design of system power factor correction to reduce utility bills which have penalty rates for excessive lagging power factor. The measured facts provided by power meters used inside of the utility service entrance are also ideal for use as operating tools.

Another application coming into widespread use today is to record and bill total energy consumption for individual sections of the plant. Combination kwh and thermal kva meters are ideal for this application. These general uses of power meters are but a few of the possible applications which plant engineers should review to achieve greater efficiency in the operation of their plant's electrical system.

Power measurements on the incoming utility service can help the plant engineer in many ways. In large plants these installations are permanent and utilize switchboard type graphic meters. An installation of this type would consist of graphic meters for measurement of kw and kvar. If billed on a kva rate structure, it would be desirable to use a kva graphic meter instead of a kw meter. A complete installation of this nature permits the industrial plant to monitor total plant load, and it identify load conditions which can be modified to reduce demand charges.

Another important advantage of an incoming service metering installation is its ability to provide data on which to establish procedures and to install equipment for controlling the power factor of the plant load when the utility rate structure penalizes the plant for low power factor conditions. Through the kw and kvar graphic meters, the plant engineer can determine the number of kilovars of power factor capacitors necessary to correct any power factor conditions which may exist. These same meters will also show the complete operation of power capacitor banks. **End**

Fig. 19. Kw thermal meter used to measure kva by changing plug.

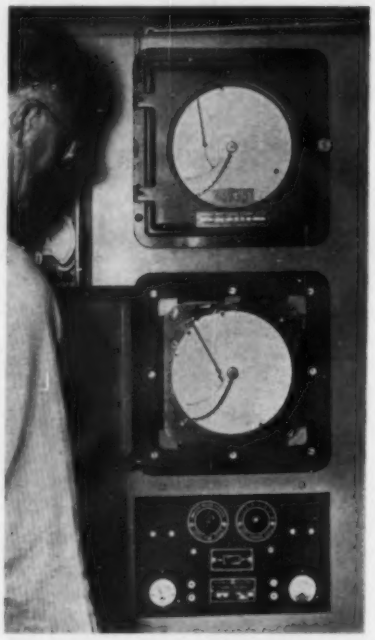


Fig. 20. Continuous survey of load is necessary for good demand control.

Fig. 1. Exterior view of grit blast room. Constructed of concrete blocks, room is integral part of main building, allowing easy access for equipment requiring blasting. Dust collector is at top, left. Note return line, for warm, filtered air.

Fig. 2. Interior view of blast room. Room is lined with ¼-in. steel plate nailed to concrete blocks. As steel is worn, room can be completely relined or patched. Note flush safety glass units installed in ceiling and grating sections in floor.

# QUICK CHANGING OF GRIT

## PERMITS BLASTING ROOM TO TAKE ON ALL METALS

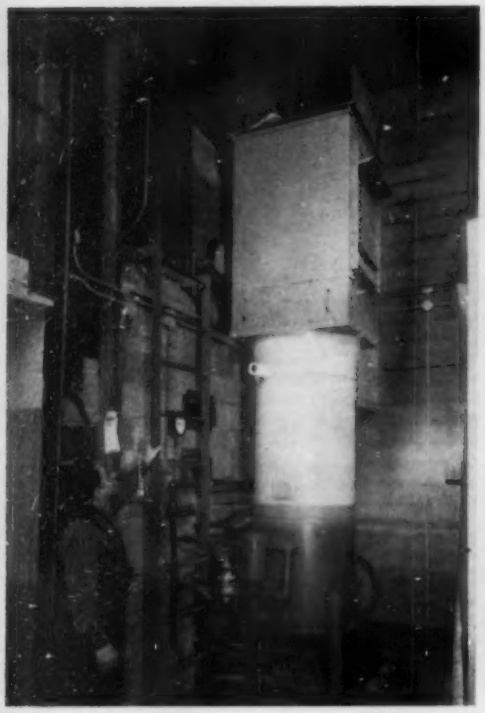
By **ANTHONY W. CITRO**, Manager of Plant Services,
Artisan Industries, Waltham, Massachusetts

WHAT WE NEEDED was a special room where we could handle all our grit blasting operations on all types of metals. These facilities were required to take care of the needs of our two firms—Artisan Metal Products which builds process equipment for the chemical and food industries and Metal Fabricators Corporation which makes chassis and cabinets for the electronic industry.

Our wide range of products required grit blasting equipment for handling stainless steel and aluminum as well as carbon steel with a minimum of wasted time during changeovers.

First we surveyed available standard equipment but were unable to find what we thought met our particular requirements. Consequently, our engineers, experienced in building custom equipment, decided to design and construct their own room and equipment using available standard components whenever and wherever possible. Some of our results may be of interest to others with a similar problem.

In a space within easy access to all plant production, we constructed our basic room from regular concrete blocks. Then, we lined the room with ¼-in. heavy steel plate, nailed to the concrete block walls. All joints were welded. This room is 11 ft by 16 ft by 9 ft high. As the steel lining is worn by the grit, the room can be either relined or repaired with steel



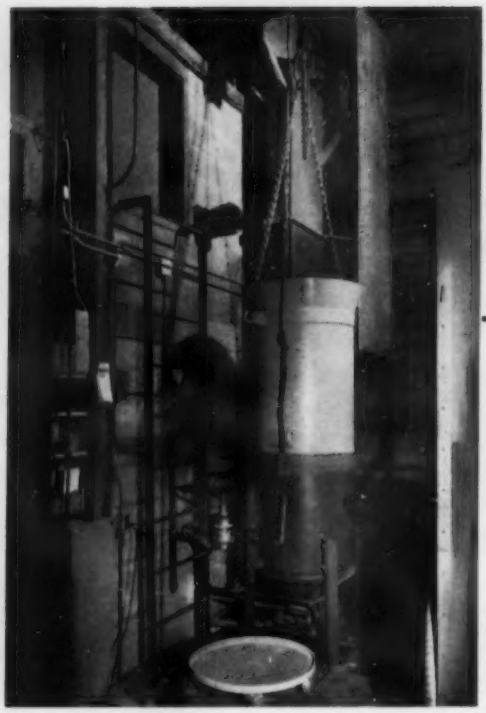


**Fig. 3, far left: Complete return system. Top square section is a separator for removing foreign objects from grit. It is resting on top of storage cylinder which feeds grit through bottom cylinder to generator then to the blasting room.**

**Fig. 4. Chain hoist is attached to one of the six cylinders which are always available with different size, type of grit.**

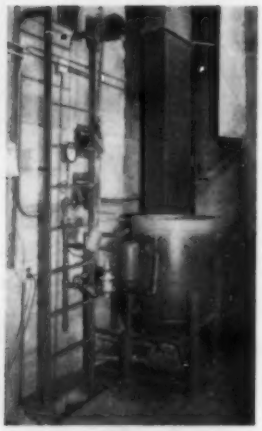


**Fig. 5. Sealed cylindrical generator contains grit supply. Compressed air and metering devices provide the right supply of grit to the gun inside the booth. Rectangular conveyor returns used grit from lower level to top unit shown in Fig. 3.**

## QUICK CHANGING OF GRIT

plate welded over the worn areas.

All known safety precautions were designed into the room. The metal door, curtained to prevent wear, is carefully fitted to keep all dust inside. On the outer wall, over the door, a red light signals "danger inside" whenever the room is in operation.

If the red light is ignored or does not work and the door is opened while the grit blast equipment is running, an automatic switch is tripped and all equipment in the room stops operating. The manual controls on the hose used by the operator in the room require constant hand pressure to work.

Then, as an additional precaution, identical safety controls used by the operator within the room are duplicated on an outside wall and located handily where the separator, storage cylinder and generator are stacked.

Quick interchange of grits was uppermost in our design requirements, as it is often necessary to change quickly from a grit for blasting aluminum, to carbon steel, to stainless, and then back to aluminum again. The booth is quickly cleaned by sweeping grit through the grid in the floor of the blasting room into a hopper below.

Then, a screw conveyor, assisted by jets of air moves the grit into an elevator which takes the grit to a separator, for removal of foreign objects, and then back into the storage cylinder. The grit blasting room can be completely cleaned in 20 minutes and the cylinders, containing grits varying from #50 to #120, can be swapped in 10 minutes by swinging them into place from storage with a chain hoist.

The dust collector, located on the roof of the blasting room, is as large as the room itself. Air sweeps across the top of the grit blasting room and takes dust created by the operation itself into the collector, where the dust settles and is bagged.

This dust control system has been so successful that the paint spray booth is located alongside the blasting room. This has saved time in moving equipment from grit blasting to painting quickly and cheaply. The air used in this operation is taken from inside the plant, where nearly a hundred men are working, and recirculated back into the plant—thus saving many dollars in otherwise lost heat energy.

The grit blast equipment is operated by an air compressor which is available for regular shop purposes.

Several months operation of this custom-designed grit blasting unit has proven to be most satisfactory and meets our requirements for all the types of metals we use. **End**

# ELECTRICALLY-OPERATED CLUTCHES AND BRAKES SOLVE CYCLING PROBLEMS

By **JAMES E. BRAAS**, Warner Electric Clutch and Brake Co., Beloit, Wisconsin

INCREASING COSTS of labor and material in industry are placing more emphasis on machine modernization for greater production. There is hardly a machine over a few years old that cannot be modernized through the use of new products that appear on the market almost daily. This emphasis on modernization presents a tremendous opportunity for plant engineers, maintenance men and mechanics to develop real savings for their companies.

In most automatic and semi-automatic machines, production can be factored down to seconds lost or gained in work cycles. Non-productive seconds needlessly lost in acceleration, deceleration, positioning, indexing, traversing and reversing, or from sluggish, outmoded control and servo devices can add up to real dollars and cents. Electric clutches and brakes, operated directly from pushbuttons, limit switches, relays, photo cells, and vacuum tubes can minimize non-productive time.

Application of electric clutches and brakes, automatically clutching and de-clutching the motor or drive shaft to the load, and the alternate engagement of the brake to the load or driven shaft, started in 1947 on machine tools. Since then, this system has been used on virtually all types of production machinery.

Applying the clutch between the motor and machine or drive and driven shaft allows the motor to run continuously at rated speed during the non-work cycle. During the work cycle no valuable time is lost in bringing the motor or shaft up to speed.

Engaging the clutch by closing a circuit somewhere in the system applies the drive to the load. The continuously running motor acts as a flywheel, accelerating the machine quickly and smoothly. On short repetitive work cycles, production is not limited to the number of times per minute the motor can be safely started. By the same token, excessive wear and tear on starting equipment and peak loads on the electrical system, due to high starting currents, are eliminated.

Applying the brake when the clutch is disengaged brings the load to a quick stop. On many machines the greatest inertia lies in the motor or drive shaft. De-clutching this inertia and braking the driven machine allows for a faster stop. Conversely, this rotating inertia is ready to accelerate the machine when starting the next work cycle.

In an in-line application, Fig. 1, the clutch couples the motor or drive shaft to the driven shaft. A common hub carries the clutch magnet and brake armature and mounts on the driven shaft. The brake magnet mounts to a fixed part of the machine.

In a secondary shaft application, Fig. 2, the clutch armature is adapted to the sheave which is bearing mounted on the shaft. With the clutch disengaged, sheave idles freely on shaft. A common hub carries the

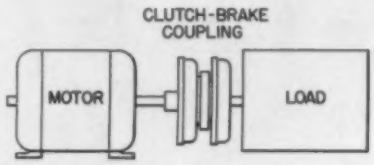



**Fig. 1. In-line application. A common hub carries clutch magnet and brake armature mounted on driven shaft. Brake magnet is attached to machine.**

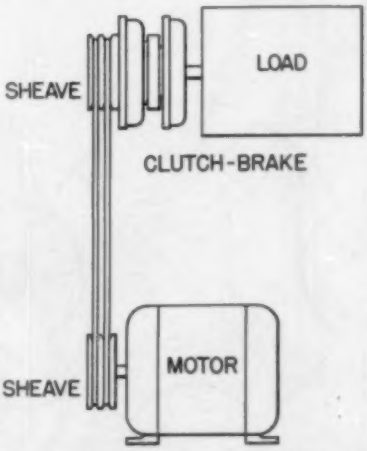



**Fig. 2. In shaft applications, clutch armature is adapted to sheave which is bearing mounted on shaft. Hub carries clutch magnet and brake armature.**

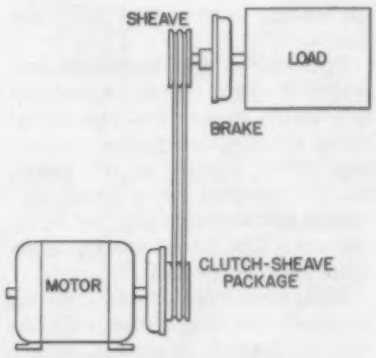



**Fig. 3. In a motor-mounted clutch-sheave application, brake is mounted on the input or secondary shaft. This arrangement adapts to most machines.**

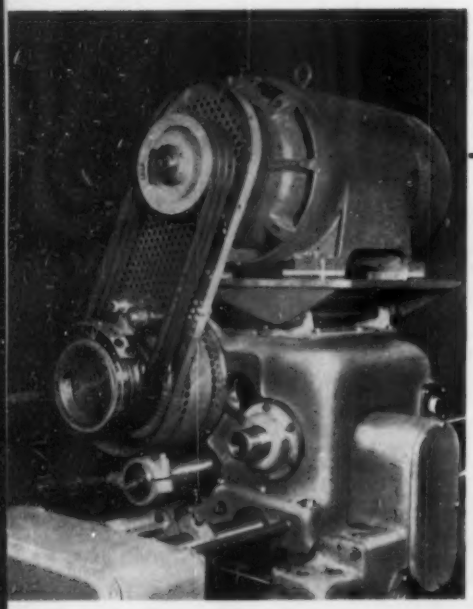


Fig. 4. Clutch and brake mounted on main drive shaft of automatic lathe. Rapid acceleration and deceleration of chuck increases machine output.

## ELECTRICAL OPERATION

clutch magnet and brake armature and attaches to the shaft. The brake magnet attaches to a fixed part of the machine.

In a motor mounted clutch-sheave package, Fig. 3, the brake is mounted on input or secondary shaft. This arrangement can be adapted to most machines quickly and simply. The clutch-sheave package will adapt to almost any motor from 1 to 25 horsepower in a matter of minutes.

Due to the simplicity of application, the system of a motor mounted clutch and brake on the secondary shaft is used by many plants in a program of modernizing while maintaining. Modernization can be accomplished in a matter of minutes as the machine is shut down for minor repairs.

Operation of electric clutches and brakes is quite simple. Essentially they are dry friction, disc-type mechanisms, actuated by magnetic attraction. They operate on d-c power, usually provided by a small conversion unit available from the manufacturer. The largest size units require less than 40 watts.

Being electrically actuated, they are extremely fast in operation, requiring only milliseconds to actuate. Clutch engagements up to 600 engagements per minutes are not uncommon. Although engagement can be measured in thousandths of a second, the build-up of the magnetic field from zero to maximum tends to take any backlash and windup out of the system.

Inherent in the design of these units is the automatic wear followup. There is never any need for adjustment during the life of the unit. The pancake design requires minimum axial clearance for installation and is ideal for adaptation to existing machinery. Further, this design offers a large area for heat dissipation, making electric clutches and brakes ideal for high cycle operation.

Potentiometers provided in the conversion units readily control the torque output of clutches and/or brakes. Varying the resistance in series with the magnet offers simple torque adjustment for acceleration, deceleration and overload protection.

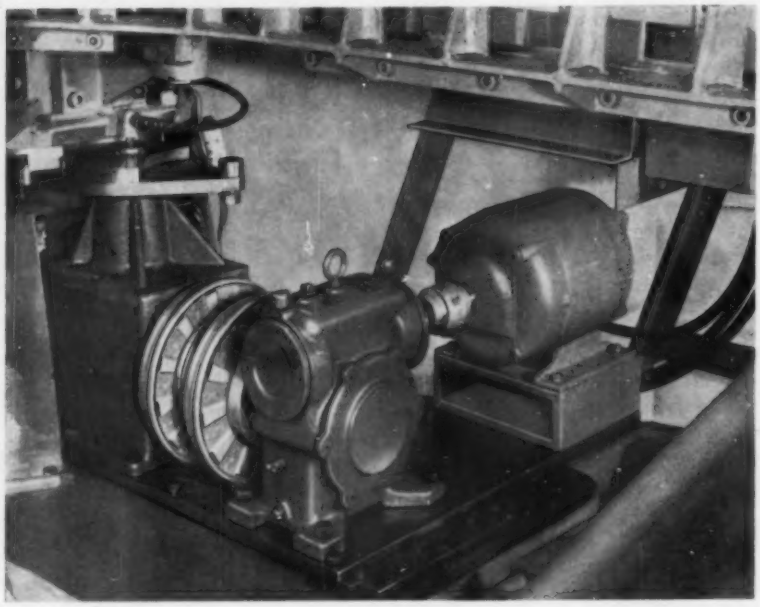


Fig. 5. Indexing table uses clutch-brake coupling mounted between gear reducer and Geneva drive. Controlled clutch torque safeguards machine.

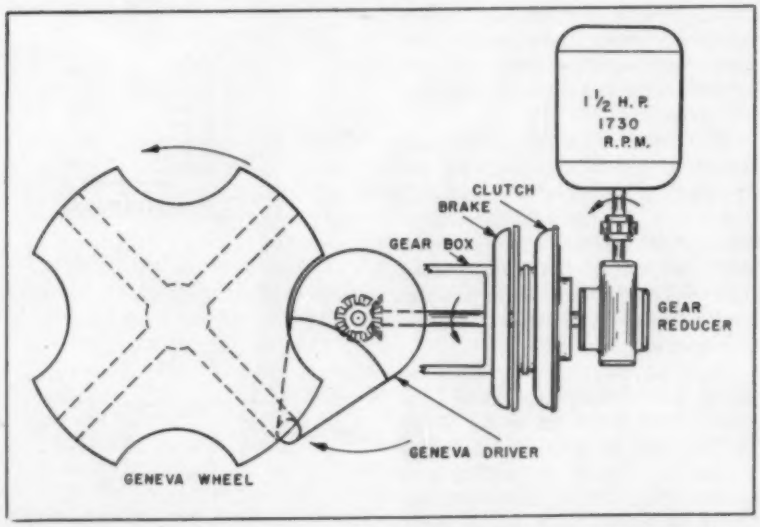



Fig. 6. Diagrammatic view of clutch-brake coupling applied to Geneva drive in Fig. 5. Drive provides accurate control of indexing and dwell cycle.

Fig. 7. Clutch and brake mounted on augers control a packaging machine.

A typical application, Fig. 4, shows a clutch-brake on a 12-in. automatic lathe. The clutch and brake are mounted on the main drive shaft, being automatically operated by a dog on the control cam-drum. The rapid acceleration and deceleration of the chuck and automatic clutching and braking makes this machine ideal for high speed production machining.

Figure 5 shows an indexing table using a 10-in. clutch-brake coupling mounted between the output of a gear reducer and the input to a Geneva drive. The clutch-brake accurately controls the indexing and dwell cycle. Controlled clutch torque safeguards the machine against jam-up. This arrangement, Fig. 6, gives simplified and accurate inching on machine setup.

In Fig. 7 we see a 5-in. clutch and brake on a vertical auger in a packaging machine. The clutch couples the drive to the auger shaft, Fig. 8, at the beginning of each filling cycle. When the exact weight, volume or count has been reached, the clutch is disengaged and the brake engaged, stopping the auger shaft. The use of the fast electric clutch and brake has increased both the accuracy of fill and the production rate. The units cycle up to 70 times per minute.

An arrangement of two magnetic clutches can be used to control forward and reverse rotation of a saddle type turret lathe. Adjacent to the forward or outer clutch is a free turning hub to which is attached a sheave, connected to the drive motor by V-belts. The forward clutch armature is keyed to the shaft supporting the hub, while the reverse clutch armature is keyed to a sleeve that is driven in the opposite direction. To stop the machine spindle, the inoperative clutch is energized through a switch to apply retarding torque.

Through their full flexibility of control, lightning-fast engagement, easy torque control, and compact design, electric clutches and brakes offer unlimited opportunities for machine modernization. The limits of the imagination are the only restraint on the application of these units. **End**

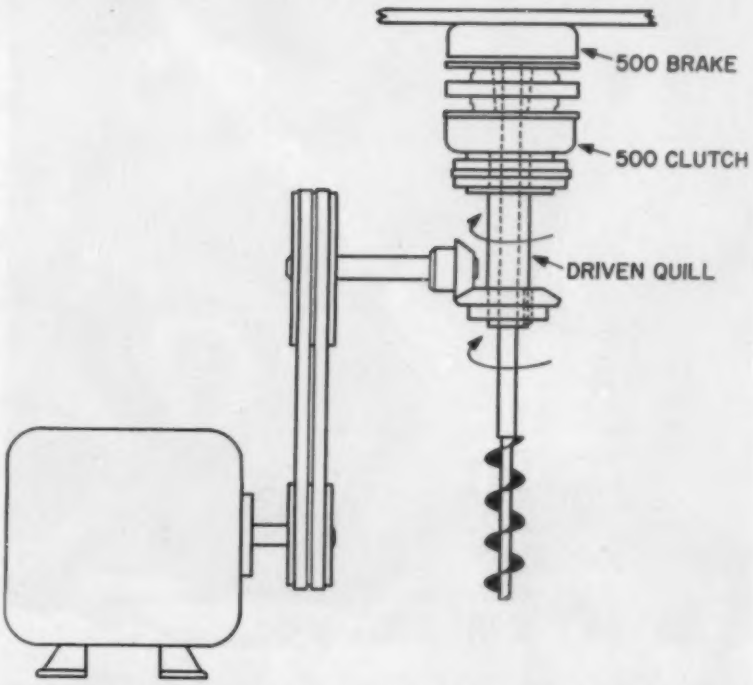
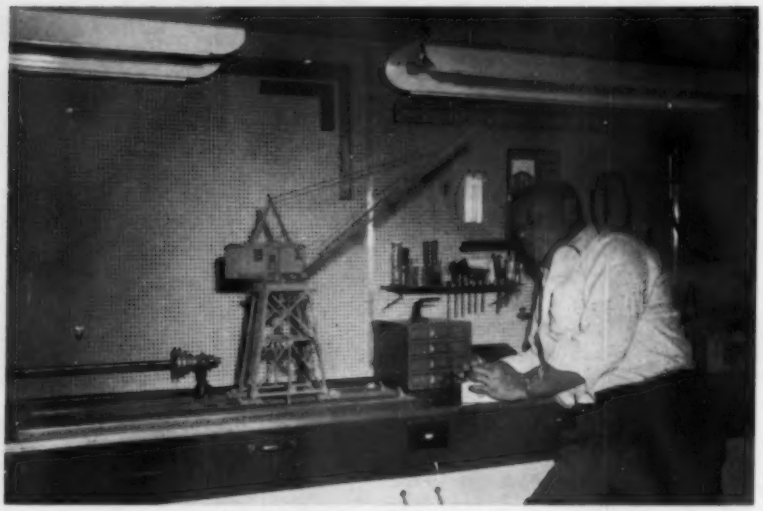



Fig. 8. Clutch in Fig. 7, drives auger shaft. When exact weight is reached, clutch disengages and brake is engaged. Unit cycles 70 times per minute.



Len Schafer, Maintenance Engineer, Dravo Corporation, shown in basement workshop with completed model of gantry crane. All parts of the crane were fabricated and joined by Mr. Schafer—the crane works, too!

# Len Schafer—
# MODEL MODEL MAKER

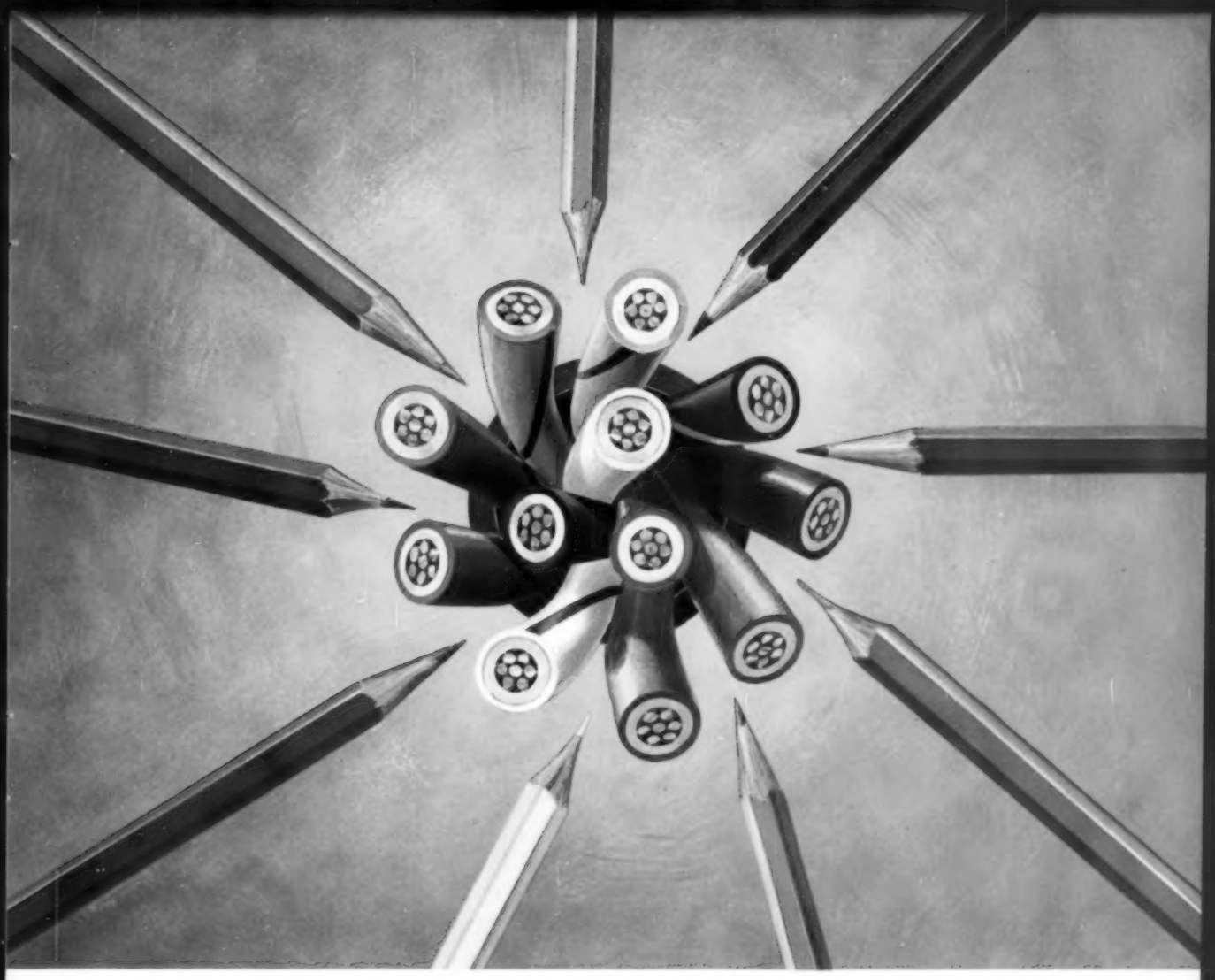
PLANT ENGINEERING has just received a communiqué from an old friend, Fran Williams, Assistant Plant Engineer, Dravo Corporation, Neville Island, Pittsburgh, Pa. Fran wants all of us to know just how handy it is to have a guy like Maintenance Engineer Len Schafer around the premises. Fran goes on to say, "Lucky indeed is our plant engineering department. We have a maintenance engineer whose hobby is precision model building.

"For instance, if a new roof ventilator is designed and a question comes up as to whether or not it will work, Len Schafer just whips up a model of the unit. Similarly, if a new drop bottom box is needed in one of the production departments, and a standard model doesn't seem to fill the bill, just call on Mr. Schafer. Given an evening or two at home and he'll come in with a model of the required unit, so accurate that it can be scaled and built without drawings.

"His crowning achievement came to light recently when he unveiled a full *working* model of a gantry-type whirler crane. This model took over two thousand hours to construct. This didn't include, as Len puts it, 'the worrying time.' Each and every component of the crane was made of small scraps of sheet metal, bent and soldered together to form beams and other structural shapes not available anywhere in the scale and accuracy needed for project." **End**

Close-up of model crane, set against a background of Dravo Corporation's works on Neville Island, Pittsburgh.

**THERE ARE MORE EDITORIAL FEATURES STARTING ON PAGE 152**



DRAW YOUR OWN CONCLUSIONS

# about the versatility of this new, standard control cable from Rome

Start by listing all the factors you consider important in a control cable.

Then compare your list with what Rome's new standard control cable (designated as the CT line) offers. We sum it up in one word: *versatility*—the ability of this new cable to meet most of your control cable needs.

For example, you can use CT cable with either AC or DC circuits. For voltages to 600 there's Type B; to 1000, Type C —both in accordance with new IPCEA-NEMA standards.

How about number of conductors? Specify from 2 to 37, in No. 10 or No. 12 AWG copper. Each conductor is insulated with polyethylene to give you maximum performance in a dielectric material, particularly where *moisture* is a problem. This insulation also stands up to acids, alkalies and oils. So CT is well suited to use in *hazardous* environments.

Over each insulated conductor you also have a Synthinol (polyvinylchloride) jacket. This same material is used to jacket the entire cable. Result: *added* resistance to heat, chemicals, and corrosion. And, good mechanical protection for the insulation, as well as a flame retardant barrier.

Full color coding (in keeping with IPCEA-NEMA, Method I) means you can make correct connections, quickly. And it will save you money in testing and maintenance.

Flexible, clean and light in weight, CT cables are also *smaller* in over-all size than similarly rated rubber-insulated cables. Use smaller conduit and fittings. Put more conductors in existing conduit, or use it in tray or trough.

*All the facts and figures about the* versatile *new CT cable —including what sizes are available "off the shelf"—are summed up in a 4-page booklet. For your free copy, write to the Rome Cable Div. of Alcoa, Dept. IN-100, Rome, N.Y.*

**Special requirements?** As a cable specialist, Rome can answer any of your control cable problems not met by this standard construction. Ask your Alcoa-Rome salesman for details.

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Today, you can order the length of high-voltage cable you need—for fast "off the shelf" delivery from Rome.

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**Popular Sizes.** 5 and 15 kv Rozone Roprene single-conductor cables are currently being stocked at Rome in the sizes most frequently needed.

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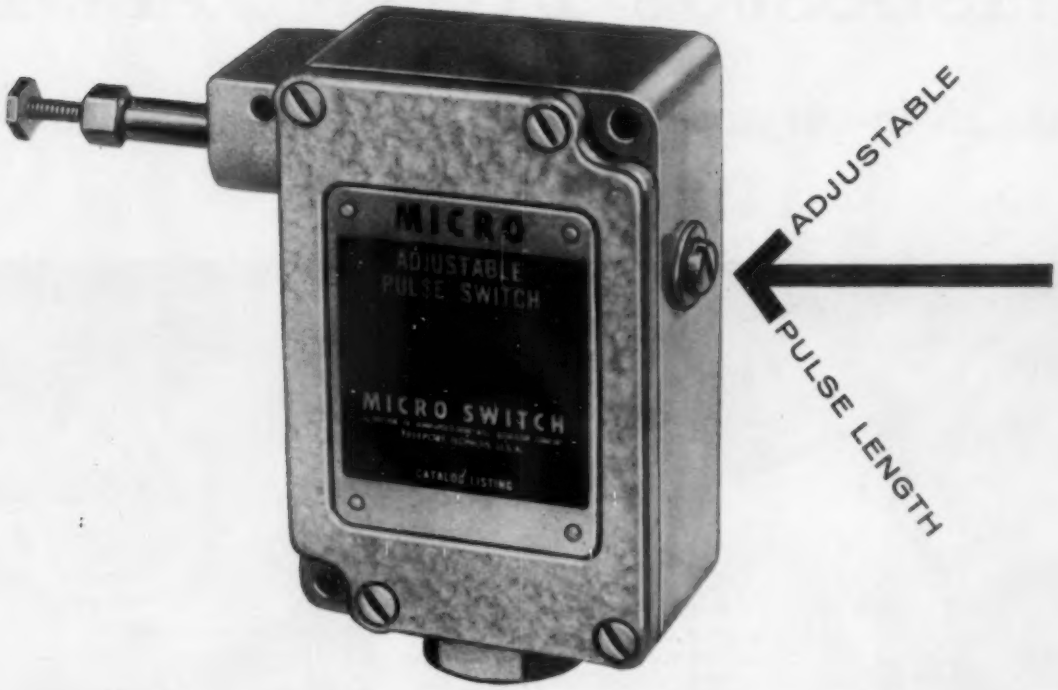


# NEW Single-Pulse Switch

## with adjustable pulse length

**EASY TO WIRE.** By removing the cover plate, the #8 binder head terminal screws are easily accessible for wiring. The "1PD1" has single-pole double-throw contact arrangement, 10 amps.—125, 250 or 480 vac.

A new limit switch has been introduced by MICRO SWITCH for applications where momentary opening and/or closing of a circuit is necessary. It is designed for control of intermittent-duty devices.

The entire pulse operation—actuation and release—is accomplished by depressing the operating plunger. An exclusive feature of the MICRO SWITCH "1PD1" allows adjustment of the pulse from .030" to .450" by simply turning a screw on the outside of the housing. The "1PD1" is sealed against oil, water and dust. Call your MICRO SWITCH Authorized Distributor or the branch office listed in the Yellow Pages. Ask for Data Sheet 173.

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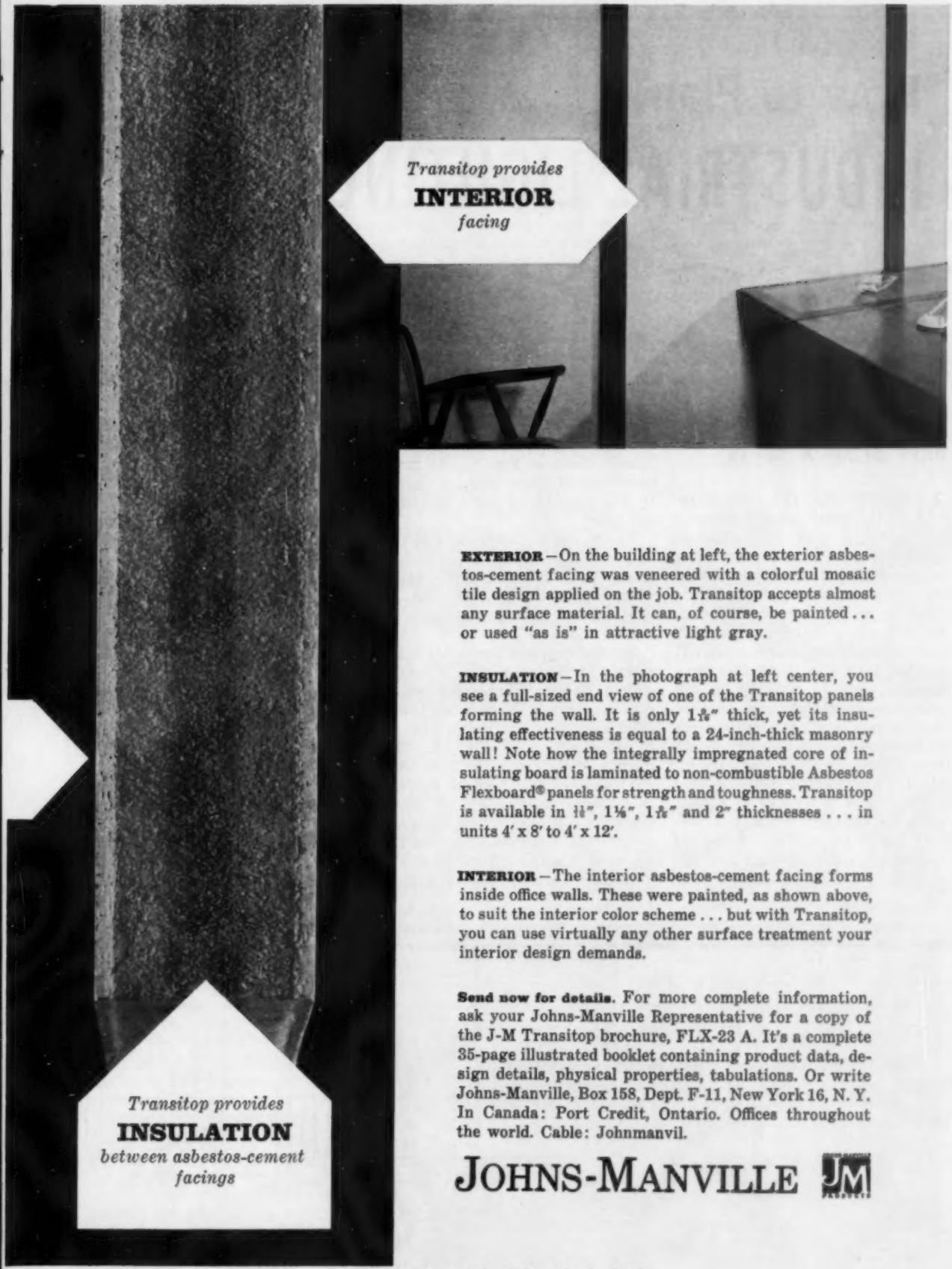
# Asbestos TRANSITOP®

*the all-in-one curtain-wall panel from Johns-Manville*

*Administration Building, Thiokol Chemical Corporation, Bristol, Pennsylvania Architect: W. Henry Neubeck, A.I.A.*




**EXTERIOR**—On the building at left, the exterior asbestos-cement facing was veneered with a colorful mosaic tile design applied on the job. Transitop accepts almost any surface material. It can, of course, be painted . . . or used "as is" in attractive light gray.

**INSULATION**—In the photograph at left center, you see a full-sized end view of one of the Transitop panels forming the wall. It is only 1⅛" thick, yet its insulating effectiveness is equal to a 24-inch-thick masonry wall! Note how the integrally impregnated core of insulating board is laminated to non-combustible Asbestos Flexboard® panels for strength and toughness. Transitop is available in ½", 1⅛", 1⅜" and 2" thicknesses . . . in units 4' x 8' to 4' x 12'.

**INTERIOR**—The interior asbestos-cement facing forms inside office walls. These were painted, as shown above, to suit the interior color scheme . . . but with Transitop, you can use virtually any other surface treatment your interior design demands.

**Send now for details.** For more complete information, ask your Johns-Manville Representative for a copy of the J-M Transitop brochure, FLX-23 A. It's a complete 35-page illustrated booklet containing product data, design details, physical properties, tabulations. Or write Johns-Manville, Box 158, Dept. F-11, New York 16, N. Y. In Canada: Port Credit, Ontario. Offices throughout the world. Cable: Johnmanvil.

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# How to Plan
# INDUSTRIAL LIGHTING

By **WILLARD ALLPHIN**, Illumination Research,
Sylvania Lighting Products, Salem, Mass.

***PART III OF A SERIES***

MERCURY LAMPS used in industry today have a mercury arc operating in a hard glass or quartz tube, the tube in turn being surrounded by a longer glass bulb. By operating at a higher pressure than the arc in a fluorescent lamp, the radiation is shifted so that much of it occurs in the visible range. It requires from 4 to 10 minutes for a mercury lamp to come up to full brightness, so most mercury installations indoors have a few incandescent or fluorescent lamps added to supply some light after any momentary interruption in electric current.

The reader is referred to a lamp guide for complete details, but mercury lamps are available in several bulb shapes and in wattages from 100 to 1000. There are also three choices of color. A clear mercury lamp delivers all of its energy at the mercury "lines" shown in Fig. 17. As mentioned earlier, these areas, if drawn to scale, would be much narrower and taller.

To the eye the appearance of the light depicted in Fig. 17 is bluish-green. A red object will appear black when illuminated by this kind of light, because there is no radiation in the red region.

In color-improved lamps, the inner surface of the outer bulb is coated with a fluorescent phosphor which converts some of the radiation below 3800 angstroms into visible light of a red orange color, Fig. 18. The mixture of the red-orange light with the blue-green light from the arc produces some improvement in color, but there is a slight loss in efficiency because the visible radiation from the arc must pass through the phosphor.

In the white lamp, Fig. 19, a phosphor is used which spreads its radiation across the entire visible spectrum. In this case there is an actual gain in efficiency along with the improvement in color. However, the net result is still one under which colors will not be rendered with accuracy.

Industrially, the principal applications for mercury lamps are in high-bay lighting and in the lighting of outdoor areas. They are most appropriate where it is desirable to provide a large amount of light in a small "package." Their high output and long life are particular advantages in hard-to-reach locations where maintenance costs are high.

Blackening of the arc tube usually means the end of normal life. A destroyed arc tube can mean that the lamp was operated on a defective ballast. The ribbon connectors inside the lamp should look bright even after the long life. If they have a blue or gray color, there is a leak in

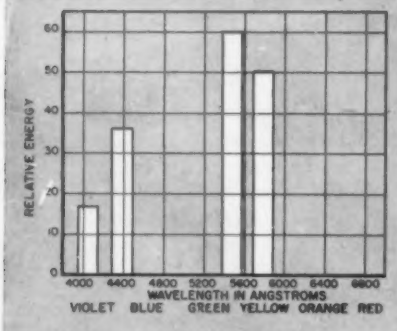


Fig. 17. Spectral energy distribution of mercury lamp. If drawn to scale, areas would be narrower and taller.

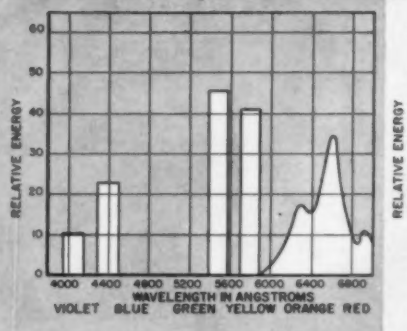


Fig. 18. Color-improved lamps use phosphor to convert radiation below 3800 angstroms into visible light.

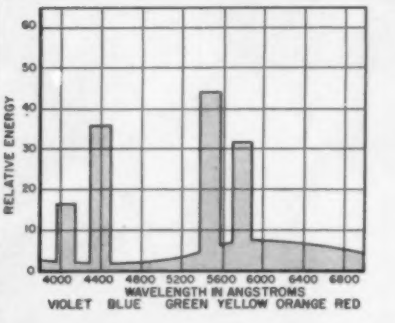


Fig. 19. In the white mercury lamp, a phosphor is used which spreads its radiation across the visible spectrum.

the outer jacket. A crescent-shaped crack on a soft glass bulb means that while the bulb was hot, a drop of water struck it at that point.

Small, portable light meters, or footcandle meters, are of three types: uncorrected, color-corrected, and a combination of color- and cosine-corrected. An uncorrected meter can be calibrated to a light source of a particular color, for example, incandescent, but it will then read incorrectly under fluorescent or mercury lighting. The reason for this is shown in Fig. 20. The uncorrected photocell and the human eye have a different response to colors of light. Therefore, the uncorrected cell cannot evaluate more than one color of lighting.

The cell of a color-corrected light meter has a filter to make its response the same as that of the average human eye, Fig. 21. These meters will read all colors of light correctly because the footcandle, as explained earlier, is based on the response to light of the average human eye.

A cosine-corrected meter registers all of the light which strikes the cell face at low angles, whereas an uncorrected meter ignores some of the light arriving at low angles. The correction becomes more important as lighter finishes are used on walls, floors, furniture and machinery, so that light is being reflected around the room in all directions.

## Footcandle Levels

Footcandle recommendations in Table I include some rather high values for certain low-contrast tasks. These values, under present practices, would be met by local lighting directed at the areas where critical seeing is required. General lighting installations seldom exceed 200 footcandles at the present state of the art.

In a direct lighting system the light goes directly from the fixtures to the working plane. In an indirect system the fixtures send the light to the ceiling, which reflects it back to the work. Most systems are a combination of these two, the percentage of upward and downward light varying with the design of the fixture. The louvered ceiling is a direct lighting system, and the luminous ceiling may be considered a special case of indirect lighting.

In the past, lighting quality has been given more attention in office lighting than in plant lighting. This was not too sensible, when it is considered that the pay of the plant workers is likely to be higher than that of general office workers. Today quality considerations are given equal weight in both applications. Lamps are shielded to hide them from view in the direct glare zone, and a part of the working light is indirect, from the ceiling. This serves the double purpose of softening shadows and preventing the disturbing contrast of bright fixtures seen against a dark ceiling.

In general, the choice of lighting system will depend on the type of work being done and the value of the product. A simple system of direct lighting fixtures may be satisfactory in a warehouse, whereas the assembly of tiny ballbearing systems for gyroscopes might be done in an air-conditioned room with a luminous ceiling.

General lighting systems for offices are almost always fluorescent, and for plant areas, are fluorescent or mercury because the cost per delivered lumen is less than incandescent. As mentioned earlier, mercury is often used in high-bay areas, particularly where it is expensive to change lamps.

In fluorescent lighting, both the 4-foot and the 8-foot lamp have their adherents. The 4-foot lamp is easier to handle in elevators and from the top of a ladder, but it takes twice as many of them to do the job. Both lamps produce the same results from a lighting standpoint.

Despite claims which have been made from time to time that a particular color is "better for the eyes" or "makes seeing easier," there is no real evidence that one color is better than another, except as a matter of individual preference or where color is really important to the operation.

Lamps should be shielded from normal viewing angles wherever seeing is at all critical. Pendant fixtures should send enough light to the ceiling so that it will not form a dark background for the fixtures. Flush troffers do not direct light to the ceiling, so when they are used it is par-

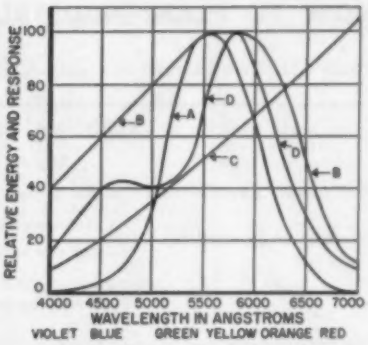


**Fig. 20. Spectral relationships of (A) response of average human eye; (B) of uncorrected selenium photocell; (C) spectral energy distribution of 500-watt filament lamp; (D) energy spread of cool-white fluorescent lamp.**

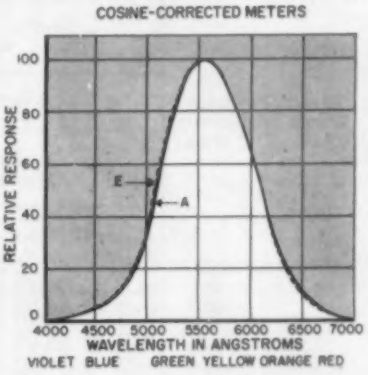


**Fig. 21. Color-corrected light meter E, has a filter to make its response the same as that of the human eye, A.**

**SLIDE RULE CALCULATOR FREE**

Attention plant engineers and electrical engineers. You will need this handy free lighting calculator to work out examples of plant and office lighting layouts to be presented in Part IV of this series. Send your request in now on company letterhead to the editor, PLANT ENGINEERING, 308 East James Street, Barrington, Ill.

Table III. Two calculations used to design plant and office lighting systems.

## Lighting Calculations

### Lumen Method

The Lumen formula used in the design of general lighting systems is:

$$\text{Number of Luminaires} = \frac{\text{footcandles X width of room X length of room}}{\text{lamps per luminaire X lumens per lamp X c.u. X m. f.}}$$

where c.u. is coefficient of utilization
m. f. is maintenance factor

The formula can also be used to solve for footcandles:

$$\text{Footcandles} = \frac{\text{number of lamps X lumens per lamp X c. u. X m. f.}}{\text{width of room X length of room}}$$

Table IV. Room ratios for dimensions found in the plant lighting layouts.

| Room Width (Feet) | Room Length (Feet) | Direct, Semi-Direct and General Diffuse — Mounting Height Above Floor in Feet: 7 | 8 | 9 | 10 | 11 | 12 | 13 | 15 | 17 | 19 | 23 | 27 | 33 | 43 | 53 | 63 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Semi-Indirect and Indirect — Approximate Ceiling Height Above Floor in Feet: 9 | 10½ | 12 | 13½ | 15 | 16½ | 18 | 21 | 24 | 27 | 33 | 39 | 48 | 63 | 78 | 93 |
| 35 | 70 | 5+ | 4.3 | 3.6 | 3.1 | 2.8 | 2.5 | 2.2 | 1.9 | 1.6 | 1.4 | 1.1 | 1.0 | 0.8 | 0.6 | | |
| | 80 | 5+ | 4.4 | 3.8 | 3.3 | 2.9 | 2.6 | 2.3 | 1.9 | 1.7 | 1.5 | 1.2 | 1.0 | 0.8 | 0.6 | | |
| | 100 | 5+ | 4.7 | 4.0 | 3.5 | 3.1 | 2.7 | 2.5 | 2.1 | 1.8 | 1.6 | 1.3 | 1.1 | 0.9 | 0.6 | 0.5 | |
| | 120 | 5+ | 4.9 | 4.2 | 3.6 | 3.2 | 2.9 | 2.6 | 2.2 | 1.9 | 1.6 | 1.3 | 1.1 | 0.9 | 0.7 | 0.5 | |
| | 140 | 5+ | 5+ | 4.3 | 3.7 | 3.3 | 3.0 | 2.7 | 2.2 | 2.0 | 1.7 | 1.4 | 1.1 | 0.9 | 0.7 | 0.6 | |
| 40 | 40 | 4.4 | 3.6 | 3.1 | 2.7 | 2.4 | 2.1 | 1.9 | 1.6 | 1.4 | 1.2 | 1.0 | 0.8 | 0.7 | 0.5 | | |
| | 50 | 4.9 | 4.0 | 3.4 | 3.0 | 2.6 | 2.3 | 2.1 | 1.8 | 1.5 | 1.4 | 1.1 | 0.9 | 0.7 | 0.6 | | |
| | 60 | 5+ | 4.4 | 3.7 | 3.2 | 2.8 | 2.5 | 2.3 | 1.9 | 1.7 | 1.5 | 1.2 | 1.0 | 0.8 | 0.6 | 0.5 | |
| | 70 | 5+ | 4.6 | 3.9 | 3.4 | 3.0 | 2.7 | 2.4 | 2.0 | 1.8 | 1.5 | 1.2 | 1.0 | 0.8 | 0.6 | 0.5 | |
| | 80 | 5+ | 4.9 | 4.1 | 3.6 | 3.1 | 2.8 | 2.5 | 2.1 | 1.8 | 1.6 | 1.3 | 1.1 | 0.9 | 0.7 | 0.5 | |
| | 100 | 5+ | 5+ | 4.4 | 3.8 | 3.4 | 3.0 | 2.7 | 2.3 | 2.0 | 1.7 | 1.4 | 1.2 | 0.9 | 0.7 | 0.6 | 0.5 |
| | 120 | 5+ | 5+ | 4.6 | 4.0 | 3.5 | 3.2 | 2.9 | 2.4 | 2.1 | 1.8 | 1.5 | 1.2 | 1.0 | 0.7 | 0.6 | 0.5 |
| | 140 | 5+ | 5+ | 4.8 | 4.1 | 3.7 | 3.3 | 3.0 | 2.5 | 2.1 | 1.9 | 1.5 | 1.3 | 1.0 | 0.8 | 0.6 | 0.5 |
| 50 | 50 | 5+ | 4.5 | 3.9 | 3.3 | 2.9 | 2.6 | 2.4 | 2.0 | 1.7 | 1.5 | 1.2 | 1.0 | 0.8 | 0.6 | 0.5 | |
| | 60 | 5+ | 5.0 | 4.2 | 3.6 | 3.2 | 2.9 | 2.6 | 2.2 | 1.9 | 1.7 | 1.3 | 1.1 | 0.9 | 0.7 | 0.5 | |
| | 70 | 5+ | 5+ | 4.5 | 3.9 | 3.4 | 3.1 | 2.8 | 2.3 | 2.0 | 1.8 | 1.4 | 1.2 | 1.0 | 0.7 | 0.6 | |
| | 80 | 5+ | 5+ | 4.7 | 4.1 | 3.6 | 3.2 | 2.9 | 2.5 | 2.1 | 1.9 | 1.5 | 1.3 | 1.0 | 0.8 | 0.6 | 0.5 |
| | 100 | 5+ | 5+ | 5+ | 4.5 | 3.9 | 3.5 | 3.2 | 2.7 | 2.3 | 2.0 | 1.6 | 1.4 | 1.1 | 0.8 | 0.7 | 0.6 |
| | 120 | 5+ | 5+ | 5+ | 4.7 | 4.2 | 3.7 | 3.4 | 2.8 | 2.4 | 2.1 | 1.7 | 1.4 | 1.2 | 0.9 | 0.7 | 0.6 |
| | 140 | 5+ | 5+ | 5+ | 4.9 | 4.3 | 3.9 | 3.5 | 2.9 | 2.5 | 2.2 | 1.8 | 1.5 | 1.2 | 0.9 | 0.7 | 0.6 |
| | 170 | 5+ | 5+ | 5+ | 5+ | 4.5 | 4.1 | 3.7 | 3.1 | 2.7 | 2.3 | 1.9 | 1.6 | 1.3 | 1.0 | 0.8 | 0.6 |
| | 200 | 5+ | 5+ | 5+ | 5+ | 4.7 | 4.2 | 3.8 | 3.2 | 2.8 | 2.4 | 2.0 | 1.6 | 1.3 | 1.0 | 0.8 | 0.7 |
| 60 | 60 | 5+ | 5+ | 4.6 | 4.0 | 3.5 | 3.2 | 2.9 | 2.4 | 2.1 | 1.8 | 1.5 | 1.2 | 1.0 | 0.7 | 0.6 | 0.5 |
| | 70 | 5+ | 5+ | 5.0 | 4.3 | 3.8 | 3.4 | 3.1 | 2.6 | 2.2 | 2.0 | 1.6 | 1.3 | 1.1 | 0.8 | 0.6 | 0.5 |
| | 80 | 5+ | 5+ | 5+ | 4.6 | 4.0 | 3.6 | 3.3 | 2.7 | 2.4 | 2.1 | 1.7 | 1.4 | 1.2 | 0.9 | 0.7 | 0.6 |
| | 100 | 5+ | 5+ | 5+ | 5.0 | 4.4 | 4.0 | 3.6 | 3.0 | 2.6 | 2.3 | 1.8 | 1.5 | 1.2 | 0.9 | 0.7 | 0.6 |
| | 120 | 5+ | 5+ | 5+ | 5+ | 4.7 | 4.2 | 3.8 | 3.2 | 2.8 | 2.4 | 2.0 | 1.6 | 1.3 | 1.0 | 0.8 | 0.7 |
| | 140 | 5+ | 5+ | 5+ | 5+ | 4.9 | 4.4 | 4.0 | 3.4 | 2.9 | 2.5 | 2.1 | 1.7 | 1.4 | 1.0 | 0.8 | 0.7 |
| | 170 | 5+ | 5+ | 5+ | 5+ | 5+ | 4.7 | 4.2 | 3.6 | 3.1 | 2.7 | 2.2 | 1.8 | 1.5 | 1.1 | 0.9 | 0.7 |
| | 200 | 5+ | 5+ | 5+ | 5+ | 5+ | 4.9 | 4.4 | 3.7 | 3.2 | 2.8 | 2.3 | 1.9 | 1.5 | 1.1 | 0.9 | 0.8 |
| 80 | 80 | 5+ | 5+ | 5+ | 5+ | 4.7 | 4.2 | 3.8 | 3.2 | 2.8 | 2.4 | 2.0 | 1.6 | 1.3 | 1.0 | 0.8 | 0.7 |
| | 140 | 5+ | 5+ | 5+ | 5+ | 5+ | 5+ | 4.9 | 4.1 | 3.5 | 3.1 | 2.5 | 2.1 | 1.7 | 1.3 | 1.0 | 0.8 |
| | 200 | 5+ | 5+ | 5+ | 5+ | 5+ | 5+ | 5+ | 4.6 | 3.9 | 3.5 | 2.8 | 2.3 | 1.9 | 1.4 | 1.1 | 1.0 |
| 100 | 100 | 5+ | 5+ | 5+ | 5+ | 5+ | 5+ | 4.8 | 4.0 | 3.5 | 3.0 | 2.4 | 2.0 | 1.6 | 1.2 | 1.0 | 0.8 |
| | 150 | 5+ | 5+ | 5+ | 5+ | 5+ | 5+ | 5+ | 4.8 | 4.1 | 3.6 | 2.9 | 2.5 | 2.0 | 1.5 | 1.2 | 1.0 |
| | 200 | 5+ | 5+ | 5+ | 5+ | 5+ | 5+ | 5+ | 5+ | 4.6 | 4.0 | 3.3 | 2.7 | 2.2 | 1.7 | 1.3 | 1.1 |
| 120 | 120 | 5+ | 5+ | 5+ | 5+ | 5+ | 5+ | 5+ | 4.8 | 4.1 | 3.6 | 2.9 | 2.5 | 2.0 | 1.5 | 1.2 | 1.0 |
| | 160 | 5+ | 5+ | 5+ | 5+ | 5+ | 5+ | 5+ | 5+ | 4.7 | 4.2 | 3.4 | 2.8 | 2.3 | 1.7 | 1.4 | 1.1 |
| | 200 | 5+ | 5+ | 5+ | 5+ | 5+ | 5+ | 5+ | 5+ | 5+ | 4.5 | 3.7 | 3.1 | 2.5 | 1.9 | 1.5 | 1.2 |

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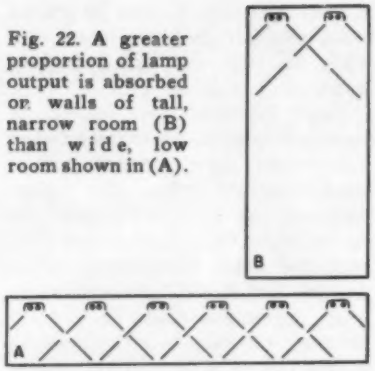



Fig. 22. A greater proportion of lamp output is absorbed on walls of tall, narrow room (B) than wide, low room shown in (A).

ticularly important that floors and furniture be finished in light colors. They will then reflect light back to the ceiling to reduce contrast.

There should be enough diffusion to avoid harsh shadows, but it should be realized that in some types of three-dimensional task, soft shadows help to delineate the task.

Maintenace is included here for the sake of completeness, but certainly the plant engineer does not need to be instructed on this consideration. From past experience he should be in a good position to evaluate a proposed fixture regarding durability, and ease of cleaning.

A regular program of cleaning lamps and fixtures is always desirable because of the very real losses which are caused by dust and dirt. The money in the electric bill goes to pay for lumens delivered at the work, but dust and dirt can absorb as much as 30 to 40 per cent of the lumens before they leave the fixture.

Table III shows two useful lighting calculations you will frequently use in plant and office lighting design. The first formula determines the number of fixtures required to obtain a given footcandle level and the second is used to determine design footcandle levels. You can use this as a check on your first calculation to find the number of fixtures required. In either case the footcandles are minimum maintained, just before the installation is cleaned.

Maintenance factor is an estimate of the percentage of the initial illumination remaining just before lamps and fixtures are cleaned. Fixture manufacturers supply suggested values for different conditions; and the engineer making the layout must decide whether the conditions are good, medium or poor. A particularly clean location, or one in which the equipment is cleaned frequently would be

considered good. An air-conditioned interior is generally clean because of the filtered air.

Coefficient of utilization takes account of the distribution of light from the fixtures, the shape of the room, and the reflectances of the principal surfaces. The shape of the room is described by the Room Ratio (formerly Room Index). The necessity for this can be seen by glancing at Fig. 22. The same lighting installation per square foot produces different footcandle levels near the floor because of the different room shapes.

The formula for Room Ratio when lighting is predominantly direct is:

$$\text{Room Ratio} = \frac{w \times l}{h(w + l)}$$

where w = width of room
l = length of room
h = mounting height of fixtures above working plane.

Unless otherwise stated, lighting calculations are based on a horizontal plane 30 inches above the floor. However, for easier use, most tables take this into account and give room ratios for mounting height above the floor.

When the lighting is predominantly indirect, the formula for Room Ratio is:

$$\text{Room Ratio} = \frac{3 \times w \times l}{2 \times h(w + l)}$$

In this case "h" is the ceiling height above the working plane, but tables give room ratio for ceiling height above the floor, Table IV.

Fixture manufacturers have slightly different ways of presenting coefficients of utilization. Table V is part of the coefficient table from the I.E.S. Handbook. Both the numerical room ratio and the older alphabetical room index are given.

Experienced lighting engineers often guess at the reflectances when making layouts. Since there is already a "guess factor" of considerable size in the formula (the maintenance factor), it can be argued that great precision is not needed in other elements of the formula. An inspection of Table V will show that wall reflectance has a relatively minor effect in large rooms. For example, Fixture No. 31, for a room ratio of 5.0 and a ceiling reflectance of 70 per cent, has a coefficient of 0.76 for 30 per cent walls and 0.73 for 10 per cent walls.

**Table V. Determining coefficient of utilization is easy with this handy table.**

Suspended Semi-Direct Fluorescent

| Typical Distribution and Maximum Spacing* | Ceiling (%) | 80 | | | 70 | | | 50 | | | 30 | | 0 | Typical Luminaire and Estimated Maintenance Factors |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Walls (%) | 50 | 30 | 10 | 50 | 30 | 10 | 50 | 30 | 10 | 30 | 10 | 0 | |
| | Room Ratio (Index) | Coefficients of Utilization (Zonal Method) For 10% Floor Reflectance (See end for 30% Floor Multipliers) | | | | | | | | | | | | |
| 29 | | | | | | | | | | | | | | |
| 15% 45% | 0.6 (J) | .18 | .14 | .11 | .17 | .14 | .11 | .17 | .14 | .11 | .14 | .11 | .10 | |
| | 0.8 (I) | .23 | .19 | .16 | .23 | .19 | .16 | .22 | .18 | .16 | .18 | .15 | .14 | |
| | 1.0 (H) | .28 | .24 | .20 | .27 | .23 | .19 | .26 | .23 | .19 | .21 | .19 | .18 | |
| | 1.25(G) | .33 | .28 | .24 | .31 | .27 | .24 | .30 | .26 | .24 | .25 | .23 | .21 | |
| | 1.5 (F) | .36 | .31 | .28 | .35 | .31 | .28 | .33 | .30 | .26 | .28 | .27 | .23 | |
| | 2.0 (E) | .41 | .36 | .32 | .40 | .36 | .32 | .37 | .33 | .31 | .32 | .29 | .27 | Plastic enclosed with apertured top |
| | 2.5 (D) | .44 | .39 | .36 | .43 | .38 | .35 | .40 | .36 | .34 | .34 | .32 | .29 | |
| Max. Spacing 1.0xMH | 3.0 (C) | .46 | .43 | .39 | .45 | .41 | .38 | .42 | .39 | .37 | .37 | .34 | .32 | Maint. Good .70 |
| | 4.0 (B) | .50 | .46 | .43 | .48 | .45 | .42 | .45 | .42 | .41 | .39 | .38 | .34 | Factor Med. .60 |
| | 5.0 (A) | .52 | .49 | .46 | .50 | .48 | .45 | .47 | .44 | .43 | .41 | .40 | .36 | Poor .50 |
| 30 | | | | | | | | | | | | | | |
| 10% 52 70% | 0.6 (J) | .31 | .25 | .23 | .31 | .25 | .23 | .29 | .25 | .21 | .25 | .21 | .20 | |
| | 0.8 (I) | .40 | .34 | .30 | .39 | .34 | .30 | .38 | .33 | .30 | .33 | .30 | .28 | |
| | 1.0 (H) | .47 | .41 | .37 | .47 | .40 | .37 | .45 | .40 | .36 | .39 | .36 | .34 | |
| | 1.25(G) | .54 | .48 | .44 | .54 | .48 | .43 | .52 | .46 | .43 | .45 | .42 | .40 | |
| | 1.5 (F) | .60 | .54 | .49 | .58 | .53 | .49 | .56 | .51 | .48 | .50 | .47 | .45 | Porcelain-enameled industrial with 13° crosswise shielding |
| | 2.0 (E) | .67 | .61 | .57 | .65 | .60 | .56 | .62 | .58 | .54 | .56 | .54 | .50 | |
| | 2.5 (D) | .71 | .65 | .61 | .69 | .64 | .60 | .66 | .62 | .59 | .60 | .58 | .54 | |
| Max. Spacing 1.0xMH | 3.0 (C) | .74 | .69 | .65 | .72 | .67 | .65 | .69 | .66 | .62 | .62 | .61 | .57 | Maint. Good .75 |
| | 4.0 (B) | .78 | .74 | .70 | .75 | .73 | .69 | .73 | .69 | .67 | .67 | .64 | .61 | Factor Med. .70 |
| | 5.0 (A) | .81 | .77 | .75 | .79 | .76 | .74 | .76 | .72 | .70 | .70 | .67 | .64 | Poor .65 |
| 31 | | | | | | | | | | | | | | |
| 20% 70% | 0.6 (J) | .32 | .27 | .24 | .31 | .26 | .23 | .30 | .25 | .22 | .25 | .22 | .21 | |
| | 0.8 (I) | .41 | .36 | .32 | .40 | .35 | .31 | .38 | .34 | .30 | .33 | .30 | .27 | |
| | 1.0 (H) | .49 | .43 | .39 | .47 | .42 | .38 | .45 | .40 | .37 | .38 | .36 | .32 | |
| | 1.25(G) | .56 | .50 | .45 | .54 | .48 | .44 | .51 | .46 | .43 | .44 | .41 | .36 | |
| | 1.5 (F) | .61 | .55 | .50 | .59 | .53 | .49 | .55 | .51 | .47 | .48 | .45 | .40 | Porcelain-enameled industrial with 30° crosswise shielding |
| | 2.0 (E) | .68 | .62 | .58 | .65 | .60 | .56 | .61 | .57 | .53 | .54 | .51 | .44 | |
| | 2.5 (D) | .72 | .67 | .63 | .69 | .65 | .61 | .65 | .61 | .58 | .57 | .55 | .47 | |
| Max. Spacing 1.0xMH | 3.0 (C) | .75 | .71 | .67 | .72 | .68 | .65 | .67 | .64 | .61 | .60 | .58 | .49 | Maint. Good .75 |
| | 4.0 (B) | .79 | .75 | .72 | .76 | .73 | .70 | .71 | .68 | .66 | .63 | .62 | .54 | Factor Med. .70 |
| | 5.0 (A) | .82 | .79 | .76 | .78 | .76 | .73 | .73 | .71 | .69 | .66 | .64 | .53 | Poor .65 |
| 32 | | | | | | | | | | | | | | |
| 20% 60% | 0.6 (J) | .31 | .26 | .23 | .30 | .25 | .22 | .28 | .24 | .22 | .24 | .22 | .20 | |
| | 0.8 (I) | .39 | .34 | .31 | .38 | .33 | .28 | .36 | .32 | .28 | .31 | .27 | .25 | |
| | 1.0 (H) | .45 | .40 | .37 | .44 | .39 | .36 | .41 | .38 | .35 | .36 | .34 | .31 | |
| | 1.25(G) | .52 | .46 | .42 | .49 | .45 | .41 | .46 | .43 | .40 | .41 | .38 | .35 | |
| | 1.5 (F) | .55 | .50 | .46 | .54 | .49 | .46 | .50 | .47 | .44 | .44 | .41 | .39 | Porcelain-enameled industrial with 30° crosswise & lengthwise shielding |
| | 2.0 (E) | .61 | .56 | .52 | .59 | .55 | .51 | .55 | .52 | .49 | .49 | .47 | .43 | |
| | 2.5 (D) | .65 | .60 | .57 | .62 | .59 | .56 | .58 | .55 | .53 | .52 | .50 | .45 | |
| Max. Spacing 0.9xMH | 3.0 (C) | .68 | .64 | .60 | .65 | .62 | .59 | .61 | .58 | .56 | .54 | .52 | .47 | Maint. Good .75 |
| | 4.0 (B) | .71 | .68 | .65 | .68 | .65 | .63 | .63 | .61 | .57 | .57 | .55 | .49 | Factor Med. .70 |
| | 5.0 (A) | .73 | .70 | .68 | .70 | .68 | .66 | .65 | .63 | .62 | .59 | .57 | .51 | Poor .60 |

* Maximum Spacing between luminaire centers for uniform illumination. MH—Mounting Height above floor CH—Ceiling Height above floor.
NOTE: All reflectances are effective values. Reproduced by permission from I. E. S. Lighting Handbook, third edition

On the other hand, for a typical semi-indirect fixture (not shown) where the room ratio is 5.0 and the wall reflectance is 30 per cent, the coefficient is 0.63 for an 80 per cent ceiling and 0.43 for 30 per cent. Fortunately, a white ceiling is almost necessarily used with semi-indirect and indirect lighting, and a new white ceiling is known to have at least 80 per cent reflectance.

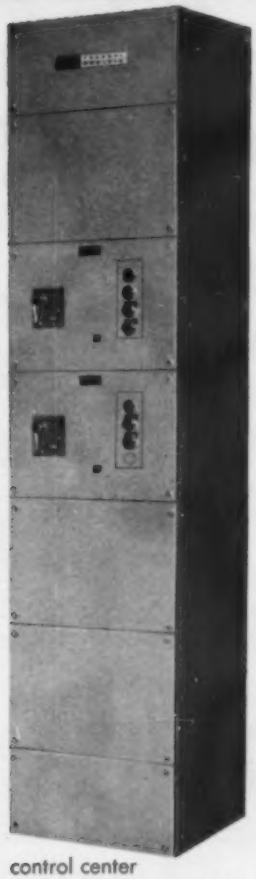
Where reflectances must be known in order to use the lumen formula as accurately as possible, they can often be obtained from the manufacturer of paint or other wall covering material.

Various simplified methods have been used to avoid the labor of applying the lumen formula. "Rules of thumb," giving watts per square foot for each kind of lighting system, or tables of approximate values have been offered. The trouble is that either the methods are quite inaccurate for certain room sizes, or various correction factors must be applied, so that one might as well have used the lumen formula in the first place. On the other hand, the lighting calculator slide rule offered in connection with this series is easy to use, and has all of the accuracy justified by the formula. **End, Part III**

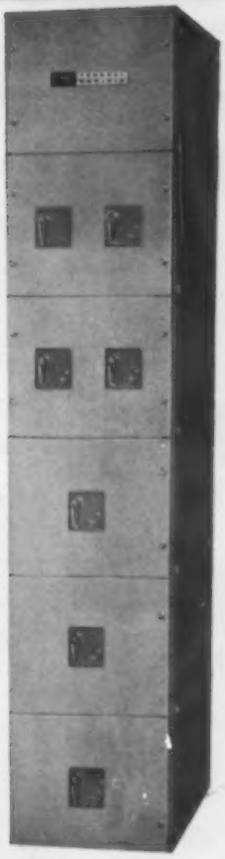
**THERE ARE MORE EDITORIAL FEATURES STARTING ON PAGE 162**

15
for safety's sake...
ON
TRIP
RESET
OFF

Rotary Handle!



control center



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# SARCO TOPICS

## HOW TO PREVENT FREEZING OF HEATING COILS

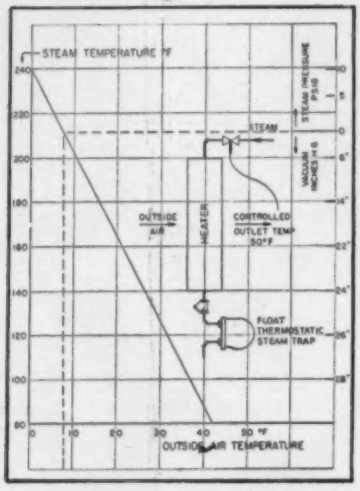
Despite the *best* "non-freeze" construction, air heating coils handling incoming air even slightly below 32° F are subject to freezing—*if they're not properly drained.*

### Are traps to blame?

Under such conditions it is easily assumed that steam trap capacity is inadequate. However, there are other, more likely reasons. Since the discharge capacity of a steam trap depends upon the pressure differential between trap inlet and outlet, a zero pressure difference will result in zero capacity, no matter how large the valve seat is.

### Why coils freeze

If the pressure at the trap inlet falls lower than pressure at the outlet, condensate cannot be discharged and will be held back in the coil. Condensate held in the coil is bound to freeze if the temperature of the air is below 32° F. As an example, consider a preheat coil designed to heat air from 0° F to 50° F, using steam at a maximum pressure of 10 psig. The chart below indicates that, as the outside air temperature rises above 0°F, the heat demand decreases, the temperature *controller reduces the steam pressure* to compensate for this reduced heat demand—and the stage is set for coil freezing.



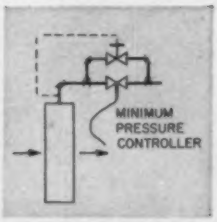

At left: chart shows how steam pressure in the heater is decreased by the modulating control as outside air temperature increases. Note that when outside air temperature reaches 7° F the pressure drops to 0 psig. In other words, unless special provisions are made there will be no pressure difference across the steam trap.

### The remedy: 3 practical hook-ups

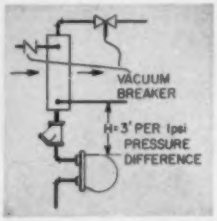
Starting with a correctly sized steam trap—and the Sarco Float Thermostatic is recommended as best suited to this type of application—freezing can be cured by preventing the pressure differential across the trap from falling below the minimum needed to discharge all the condensate as rapidly as it forms. Here are three practical methods.

### 1. Arrange a pressure controlled bypass around the temperature control valve

This keeps the pressure in the heater from falling below a preset minimum. With this solution, however, the temperature controller is not effective over the full range of outside air temperature.




Schematic hookup for pressure controlled bypass around temperature control valve.



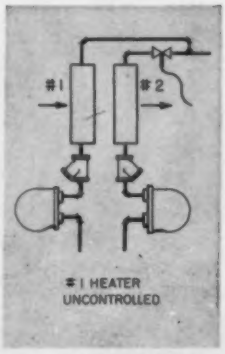

Hookup for installing steam trap below unit.

### 2. Install the steam trap well below the unit

This provides a hydraulic leg which allows the trap to discharge even with a vacuum in the steam space. A vacuum breaker should be installed at the top of the condensate header of the heater. To calculate the hydraulic head needed, use 3' per 1 psi pressure differential. Example: if trap has required capacity at 1 psi differential, minimum head is 3'.

### 3. For a new installation, divide the preheater into two sections

The first section should be capable of raising the air to at least 32° F under minimum outside air conditions and the second to raise the air from 32°F to the final temperature. The first coil would be supplied with steam at full pressure at all times, while the second would be controlled to maintain the final temperature needed. The first coil could not freeze because of steadily maintained pressure, and the second would not freeze because the air temperature would be above 32° F.




Hookup for dividing preheater into two sections.

**FIGURE IT OUT AT A GLANCE. "FREEZING POINT DANGER KIT" — FREE.** Contact your Sarco Sales Representative, or write

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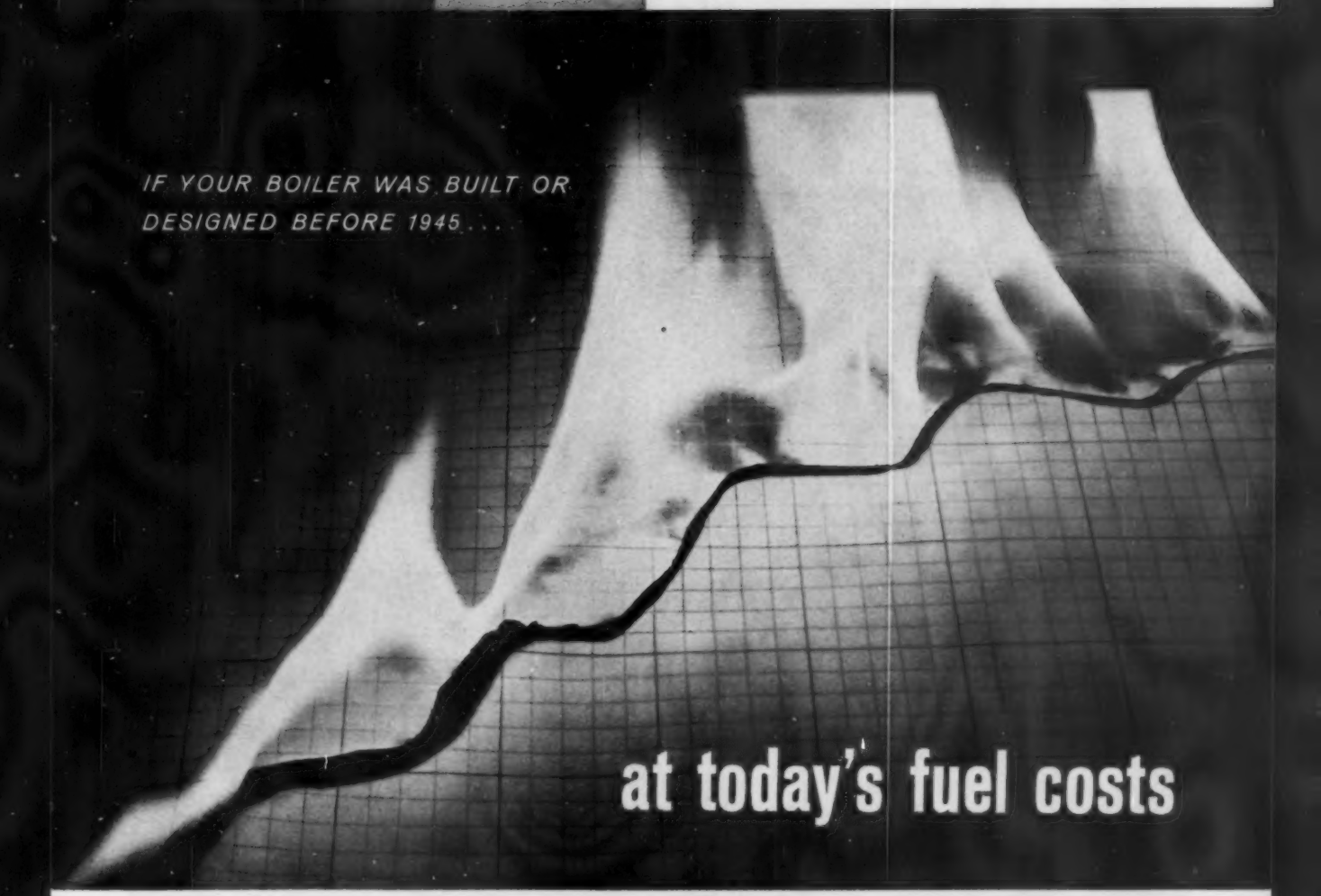


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See your local Cleaver-Brooks agent for more detailed information, or write for the booklet, *How to Select a Boiler.*

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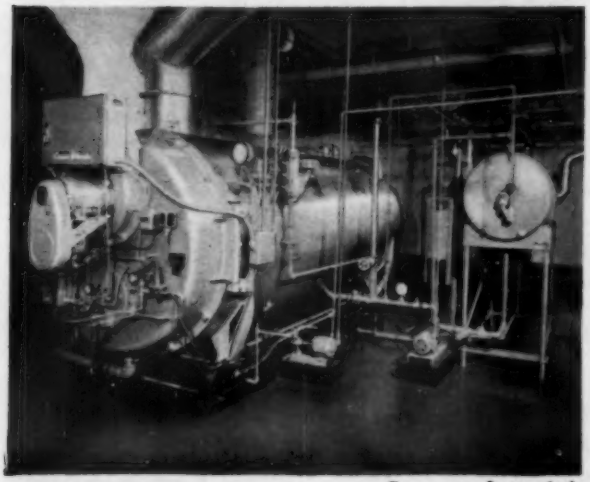

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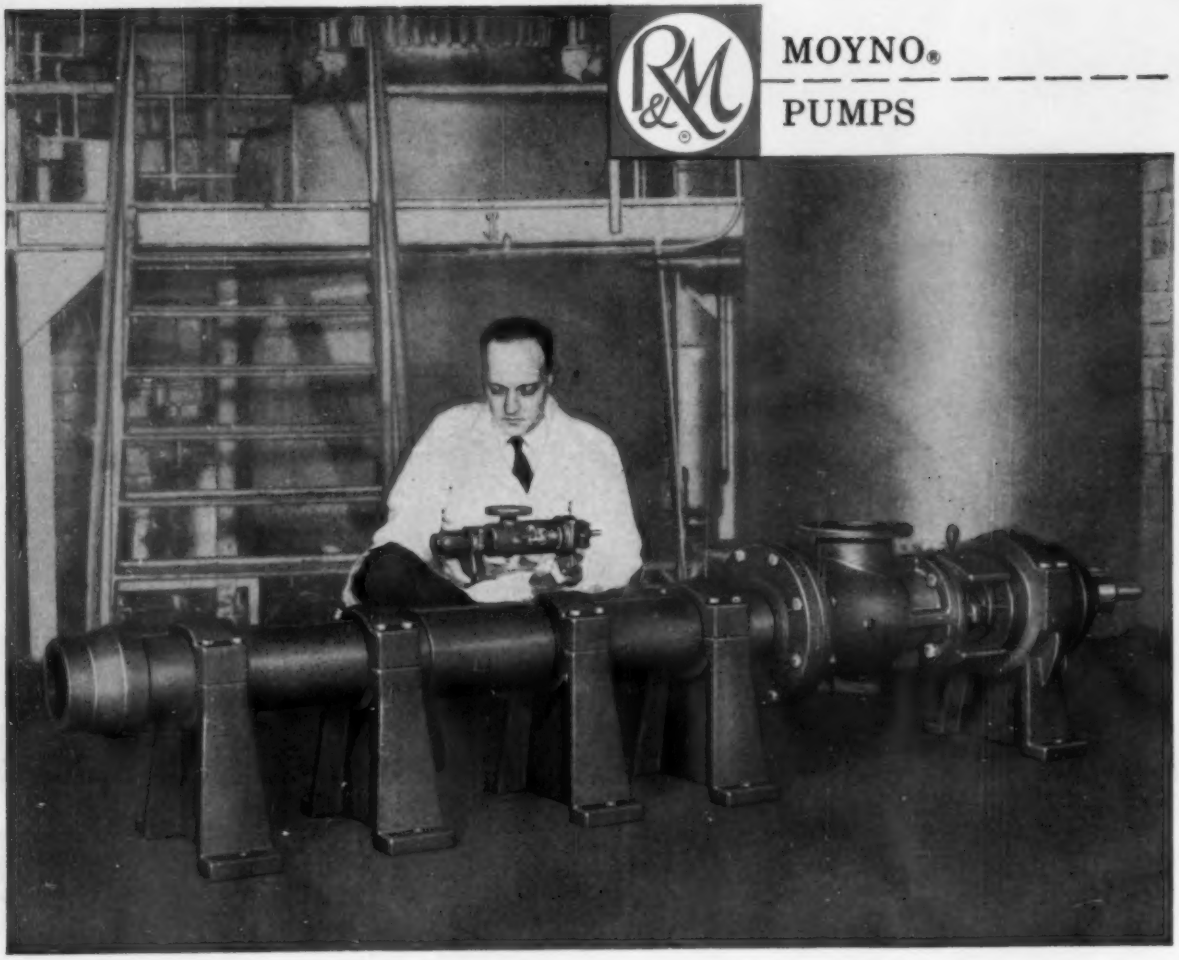

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# MOYNO® PUMPS

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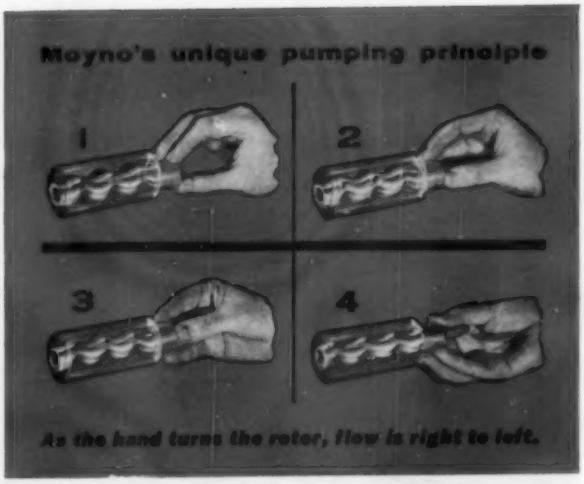


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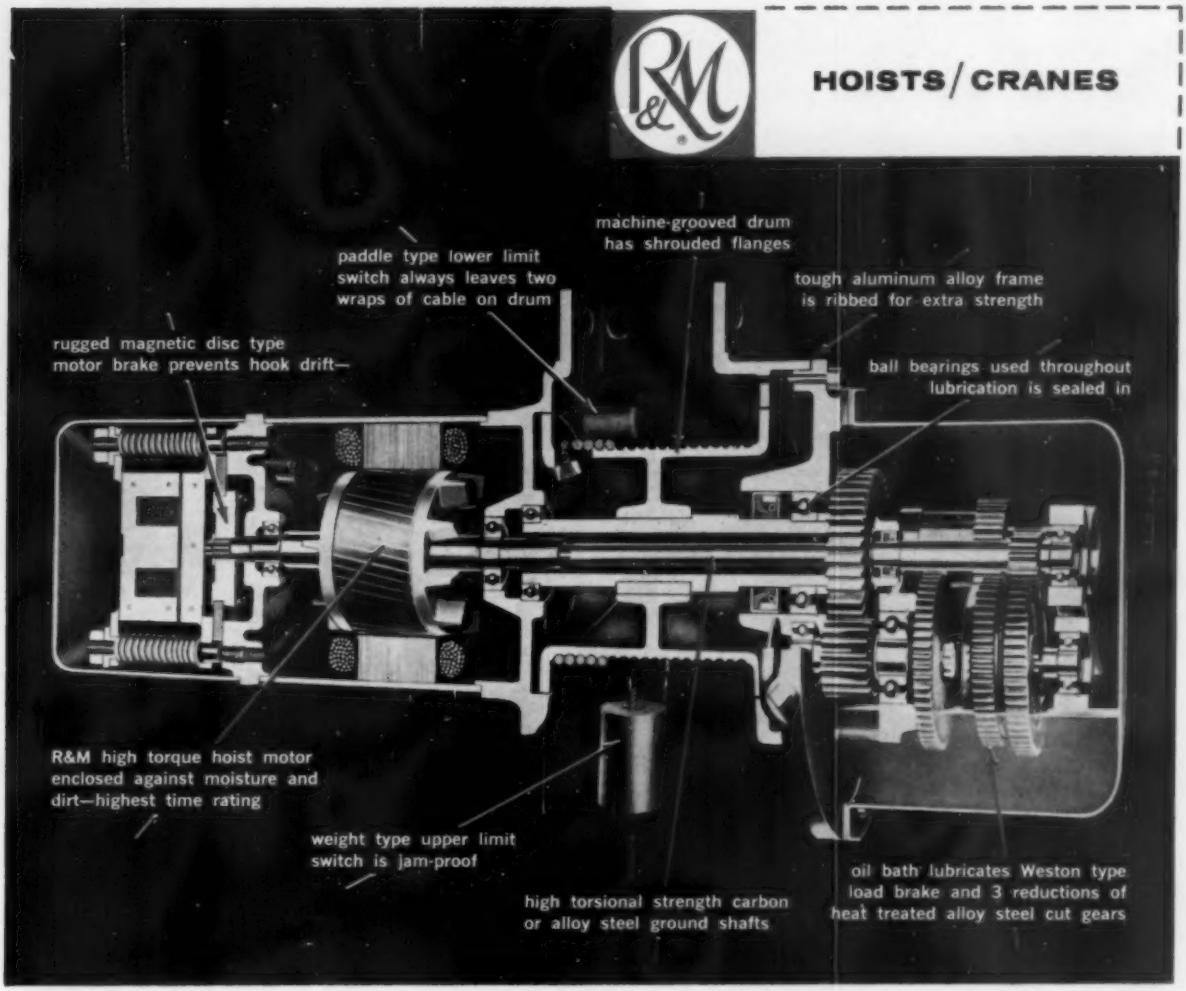
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*Type J hoists: seven bonus-packed models.*

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# CONTROLS, EDUCATION END WATER WASTE

By J. D. McCLURE, Maintenance Foreman and
R. N. THRASH, Manufacturing Engineer, Athens Div. General Time Corp.

WHEN OUR PLANT was opened in 1954, we instituted a water conservation program that gave prompt attention to defective valves in our plating room, in the rest rooms and on the water cooler. This was partly for reasons of economy and partly because the Athens, Ga. Municipal Water Works had a daily capacity of only 5-million gallons.

Although an addition to the water works is now under construction and there will be no water shortage in the forseeable future, we have continued to install additional water-saving equipment. We also continue to educate our employees on the efficient use of water.

The major portion of our water is used in the plastics department, plating department, and for cooling two 40-hp air compressors. The plating department is by far the largest user. At present we do not recirculate any of our water, but we are piping waste water from some other departments to the plating room, where it is used in rinse tanks. We have no plans for the reuse of water from our plating rinse tanks at the present time.

We have thermally controlled water flow valves on our air compressors, plastic molding machines, degreaser and still. On the air compressors a temperature control valve was installed in the water line on the inlet side of the compressor cooling jacket, with the sensing bulb on the outlet side of the cooling water line. This valve regulates the flow of water needed for maintaining a temperature of 110 to 125 F on the cooling jackets. In addition to this control valve, a water temperature sealing device was installed in the water jackets as a safety measure to stop the compressors if the temperature exceeds 140 F.

## Manual Control Inefficient

Prior to the installation of these valves, the flow of cooling water had to be controlled manually. This required constant manipulation to maintain the proper temperature on the water jackets because of changes in water temperatures and compressor load. Due to the constant attention required, the manually operated valves were usually left open enough to provide the maximum amount of cooling needed. This resulted in the use of approximately five times as much water as was necessary. In addition, the compressors were, at times, cooled to too low a temperature causing excessive wear on them and condensation of water in the compressor cylinders.

Water supply valves are now left open and the water is turned on and off at the same time as the compressors by means of a solenoid valve, which was standard equipment. The temperature control valve then regulates the amount of water used. This arrangement has resulted in a reduction of water used from 1375 gphr to 275 gphr for each compressor. This water is then available for reuse in the plating department rinse tanks.

In our plastics molding department, all injection molding machines are equipped with temperature control valves to conserve cooling water and to maintain a temperature of approximately 100 F for the hydraulic oil in the machines. All waste cooling water coming from this department during the first and second shifts is used in the plating rinse tanks. Third shift waste is used for watering the grounds. We are considering the possibility of installing a cooling tower to serve the plastics department so that we can recirculate this water.

In our plating department a temperature control valve was installed on our automatic degreaser in the inlet side of the condensing water line, with the sensing bulb on the outlet side. This valve is set to maintain a water temperature of from 110 to 130 F on the outlet side of the condensing coils. Waste water from the condensing coils is used in the plating rinse tanks.

A control identical to the one used on the automatic degreaser was installed in the water line to the trichlorethylene still. The sensing bulb was placed in the center of the water tank between the condensing coils. This valve was adjusted so that a temperature of from 110 to 130 F is maintained. Prior to the installation of this valve the water supply was

Fig. 1. Injection molding machines have temperature control valves. Waste cooling water is sent to plating rinse tanks.

Fig. 3. View of temperature sensing bulb and control valve on compressor. Valve regulates flow of water to maintain 110 F to 125 F on cooling jackets.

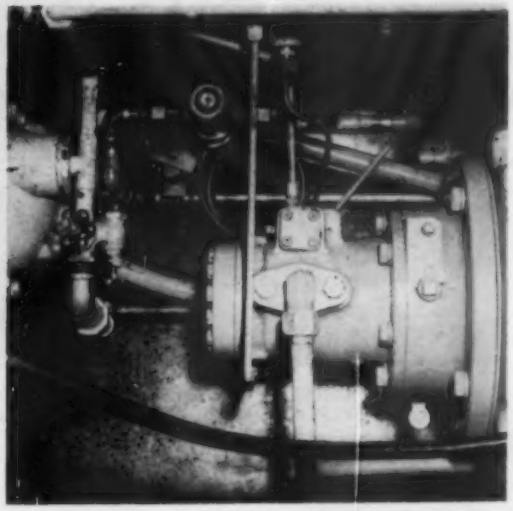
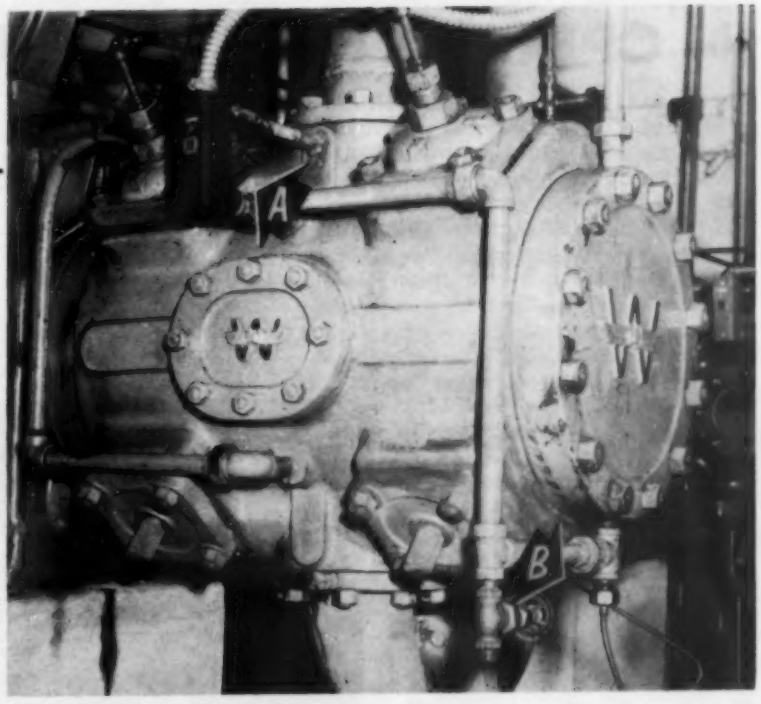


Fig. 2. Water temperature sensing device A, was installed in water jacket as safety measure. B shows sensing bulb for temperature control valve on opposite side of compressor.




controlled manually, which usually resulted in a steady flow of water at all times during the still's operation. The installation cut the water use by approximately 75 per cent.

In addition to the installation of the water saving devices mentioned, we have a program for prompt attention to defective valves in rest rooms, on water coolers, and in the plating room. Plating room supervisors constantly stress and check on wasteful use of water, such as allowing valves to remain open and poor control of water flow for operational needs. A water meter has also been installed in the plating room to check on water usage and to detect any unusual variation from normal.

We have found it unnecessary to chemically treat any of our water, with the exception of that used in our boiler and air conditioning unit. This treatment was recommended by a chemical company, and is done manually each morning. The boiler water is treated for scale and corrosion, and the air conditioning water is treated for scale, corrosion, and algae. The air conditioning water supply is treated only when the unit is operating, which is approximately eight months each year.

We have estimates available, and are considering drilling a well to supply approximately 250,000 cu ft of water per month. When this is done, and an adequate stream of water is tapped, we expect to save 75 per cent of our water bill each month and amortize the cost of well and equipment in less than two years, taking into consideration the possibility of having to drill a second well to meet our water requirements.

Since a city ordinance states that all water users outside the city limits must pay double the rate of in-city users, drilling a well, or wells, for our own water supply would be for considerations of economy only. **End**

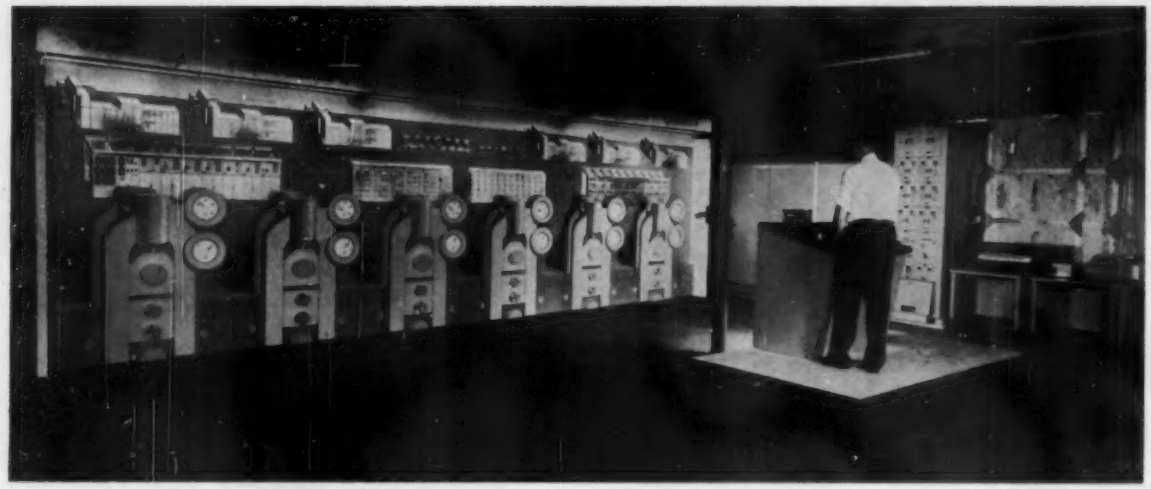


Fig. 1. Mock rolling setup used to demonstrate application of computer to steel processing; computer is at right.

# COMPUTER SHOWS PROWESS IN OPERATION OF MOCKUP

A MOCKUP OF AN automated strip mill performed some make-believe rolling in a demonstration prior to its appearance at the 1960 Iron and Steel Exposition in Cleveland. In this "roll-your-own" operation the strip requirements were simply dialed on the console sitting in front of the mill, and the computer along with the supporting equipment handled the job.

Settings that the operator dials are the incoming slab gage, temperature of the slab, and the required finished gage. Then a start button is pushed and the computer takes hold and with the aid of the Directo-Matic control system brings about the proper rolling settings for the job at hand. If, however, the incoming slab temperature is set either too high or too low on the dial, no rolling will take place. The reason for this is typed on the automatic typewriter indicating that the steel is either too hot or too cold.

The passing of the steel through the stands is simulated by the progressive illumination of translucent panels running to and from the rolling stands. Speeds and gage settings are shown on dials at each station.

According to W. E. Miller, Manager Rolling and Processing Engineer, General Electric Co., automatic gage control has lived up to its expected capabilities in actual performance. Except for the first 30 ft of strip, and for the tail remaining after the strip exits from the next to the last stand, all of the coil is within 1/1000 in. of desired gage for well-heated slabs in which there are large temperature variations due to cold furnace skids. With the complete automation system incorporating the General Electric computer and Directo-Matic control, the first coil after a thickness change can be almost completely within commercial tolerance. **End**

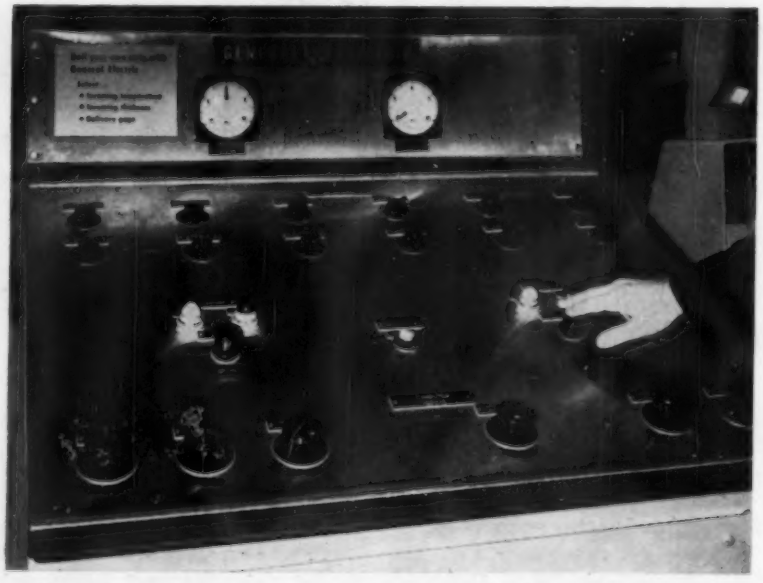


Fig. 2. After dials are set on console, button is pushed, computer takes over.

# HOW TO DESIGN

# PNEUMATIC-HYDRAULIC ACTUATION SYSTEMS

ELEVENTH IN A SERIES OF ARTICLES

## Part XI. Designing pneumatic-hydraulic systems for positioning workpiece for testing, gaging

AS WE FURTHER automate in our production processes we find more and more applications where fluid power equipment can be used for testing and gaging of parts. It is even more important in this age that the testing or gaging be accurate and accomplished in the shortest possible time.

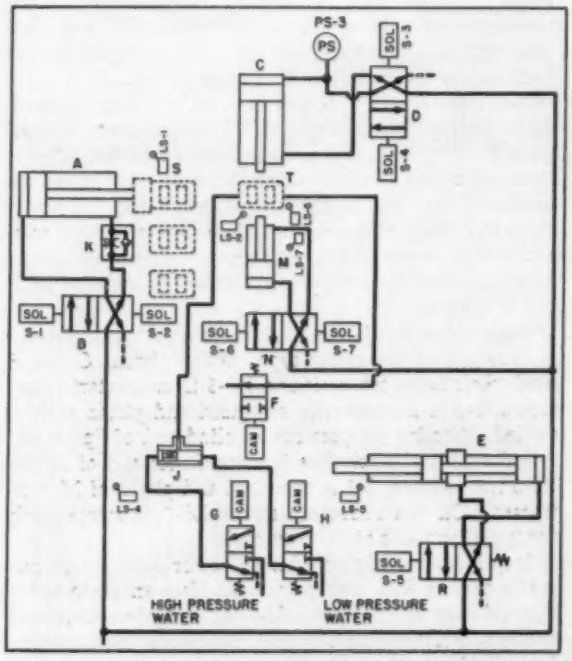



Fig. 1. The above circuit is used for testing workpiece, first by visual means; then under pressure for porosity.

There are many cast parts made of aluminum, brass, steel and iron that must be pressure tested. In order to save valuable machining time, the first testing generally takes place when the casting is in the "as cast" condition. The second testing may take place after the first machining operation or after the casting is completely machined. The pressure testing is to detect whether or not porosity is present.

To increase production and not lose too much non-productive time through testing, various devices have been devised to automatically test a workpiece. Some of these may become quite complicated due to the nature of the workpiece.

In pressure testing of non-porous workpieces such as lengths of steel, aluminum or brass tubing; rubber hose assemblies and the like, the test is usually for checking the bursting strength or the safe working strength.

Cables and ropes may be tested with fluid power equipment to check the breaking point. Testing is also performed on springs and many other workpieces to check their life expectency on an accelerated test basis.

In this article we will present some of the circuits which

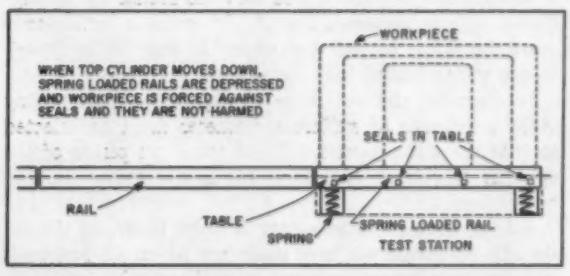

WORKPIECE
WHEN TOP CYLINDER MOVES DOWN, SPRING LOADED RAILS ARE DEPRESSED AND WORKPIECE IS FORCED AGAINST SEALS AND THEY ARE NOT HARMED
SEALS IN TABLE
RAIL
TABLE
SPRING
SPRING LOADED RAIL
TEST STATION

Fig. 2. Special devices should be employed in positioning workpiece prior to testing so that seals are not damaged.

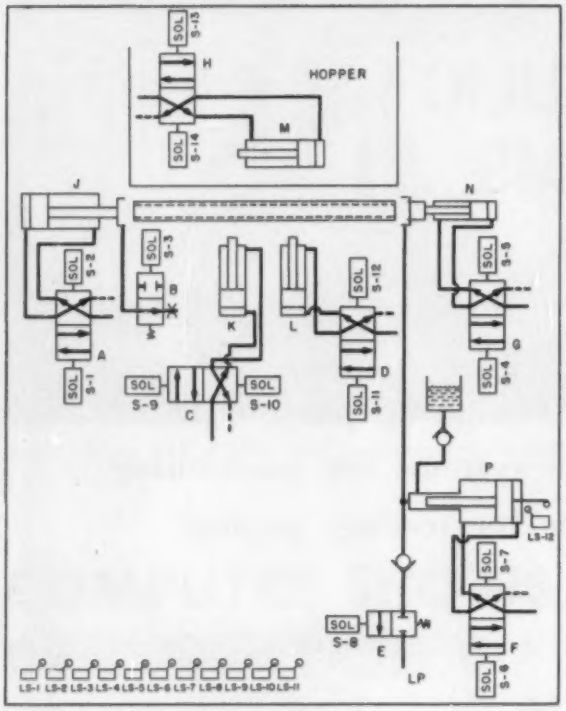



**Fig. 3. Pressure-testing tubing. Circuit uses air-to-water-hydraulic or oil-hydraulic-to-water-hydraulic intensifier.**

can be applied for testing as well as gaging applications. To meet your particular application it may be necessary to make a slight modification to the system.

Let us look at some of the circuits which can be used. In Fig. 1, our circuit has a two-fold purpose. First it tests the workpiece for flow by visual means under normal operating pressure and then under high pressure for porosity. The first test determines if any of the passages are partially closed off due to shifting of the coring. Vacuum is also used for testing porosity. If porosity is present the reading on the vacuum gage will decrease.

In Fig. 1 the workpiece is moved down the conveyor and moved into the testing fixture by an air cylinder due to its weight. Lighter pieces may readily be placed into the fixture by hand unless the production warrants an automated setup.

If the workpiece is pushed into the test station, it should be done so that it will not damage the seals. One method is to have the workpiece ride into the station on spring-loaded rails as shown in Fig. 2. Of course a lot depends upon the shape of the workpiece. It may be necessary to use spring-loaded balls or rollers.

In clamping the workpiece during the pressure-testing cycle a cylinder of sufficient diameter must be selected so that the test pressure will not cause the piston of the cylinder to retract and allow the high pressure fluid to be released.

In Fig. 1 you will note that in order to set up the automatic operation we have made use of an air-hydraulic cylinder to act as a timing device. It affords a wide variety of speeds by a simple adjustment of a needle.

Here is how this circuit operates: workpiece, after it has been machined moves down the conveyor to transfer station S where limit switch LS-1 is contacted. This energizes solenoid S-1 of valve B and air pressure is directed to blind end of cylinder A. Piston of cylinder advances at a speed set by flow control K. The speed at which the workpiece is advanced to the test station is real important. Weight and material of workpiece must be taken into consideration. The speed can be readily changed by changing the orifice size in flow control K.

As workpiece is moved into station T, LS-2 is momentarily tripped, and solenoid S-2 is energized, directing air pressure to rod end of cylinder A and piston is retracted, making ready for next transfer operation. It is well to cushion the blind end of cylinder A. At the same time LS-2 causes solenoid S-3 of valve D to be momentarily energized and air pressure is directed to blind end of cylinder C.

## Workpiece Is Clamped in Fixture

Piston of cylinder C advances rapidly and workpiece is securely clamped in pressure-test fixture. As pressure builds up between valve D and blind end of cylinder C, closing contacts of pressure switch PS-3, solenoid S-5 of valve R is energized, directing pressure to blind end of timing cylinder E. Piston starts to advance and cam on end of piston rod depresses roller of low pressure three-way valve H, allowing low pressure test fluid to flow to shuttle valve J and then on to workpiece. With passage in two-way valve F open, operator can watch fluid pass from workpiece and can visually check flow by a flow meter or some other flow-timing device.

As piston of E further advances, cam drops off of roller H and depresses roller of valve F, closing passage. Cam then depresses roller of high pressure valve G, and high pressure fluid is directed through valve J to workpiece. Operator checks workpiece for porosity.

Cam rides off roller G and then off of roller F, which blocks the high pressure and allows fluid to drain through valve F. As piston E approaches end of stroke, LS-4 is contacted which energizes solenoid S-4 of valve D and air pressure is directed to rod end of cylinder C. Piston C starts to retract, releasing workpiece. At same time solenoid S-5 is de-energized and contacts of pressure switch PS-3 open and air pressure is directed to rod end of E and E retracts.

Cams on end of piston rod ride free on the return stroke as they are of the swing type. When pistons C and E reach their retracted positions, LS-5 is momentarily contacted. S-6 is momentarily energized and piston of N is shifted, directing air pressure to blind end of "push off" cylinder M and workpiece is ejected. At end of stroke, LS-6 is contacted, S-7 is energized and piston of M is retracted. On the retracting stroke LS-7 is momentarily contacted and this starts next cycle.

In pressure testing of tubing, pipe or hose we are generally dealing with high pressures. Here an air-to-water-hydraulic or an oil-hydraulic-to-water-hydraulic intensifier is generally a big help and reduces the heat problem. In this circuit the tubes are being automatically tested in order to save time and reduce costs.

In Fig. 3 tubes are fed into loading station by a hopper-type conveyor which only allows one tube at a time to drop into the test station. In testing at high pressure it is desirable to eliminate the trapped air and protect the operator or observer from the spraying of high pressure fluid. Operator should be protected in case the piece being tested should burst.

Tube is released from hopper as LS-1 is momentarily contacted. The tripping of this limit switch energizes S-13 of four-way valve H and directs air pressure to blind end of hopper door cylinder. This opens door and tube is released. LS-2 is momentarily contacted which momentarily energizes S-14 and air pressure is directed to rod end of cylinder M and door is closed. At the same time S-1 is energized and air pressure is directed to blind end of locating cylinder J and tube is located in testing fixture, sealing both ends of tube.

LS-3 is then contacted, energizing S-8 of two-way, low-pressure fill valve and tube is filled. As LS-3 is released, S-8 is de-energized, closing valve E, LS-4 is contacted, energizing S-3 of valve B and passages in two-way valve B are closed. LS-5 is contacted which momentarily energizes S-7 of four-way valve F, and air pressure is directed to blind end of intensifier P. Piston advances forcing high pressure fluid into test system.

When pressure test has been completed, LS-6 is momentarily contacted and S-6 is momentarily energized. This shifts spool of valve F and air pressure is directed to rod end of intensifier cylinder P. Piston of cylinder retracts, releasing pressure. LS-4 is released, opening valve B and water drains from tube. LS-7 is contacted which causes S-2 and S-4 to be energized.

Air pressure is then directed to rod end of cylinder J and blind end of cylinder N. Piston J retracts and piston N advances, pushing tube out of closing device. LS-8 is then momentarily contacted which energizes solenoid S-9 of valve C, and directs air pressure to rod end of sorting cylinder K. Piston K retracts and tube rolls onto conveyor which accepts tubes that meet the pressure test.

If a tube bursts when being tested, piston in the intensifier will move its full stroke and contacts a switch which energizes solenoid S-12. Piston of sorter tube L retracts and tube will be moved onto a conveyor accepting rejected tubes. When tubes move onto either conveyor, piston K or L will return to their normal position as limit switches, LS-9 or LS-10 are contacted. LS-11 causes piston of N to return to normal position.

The sequence of tripping the limit switches can be accomplished by using an air-hydraulic cylinder with swing type trips, an electric motor drive with a speed reducer, or an electric timing mechanism.

In testing tubes satisfactory seals must be placed in

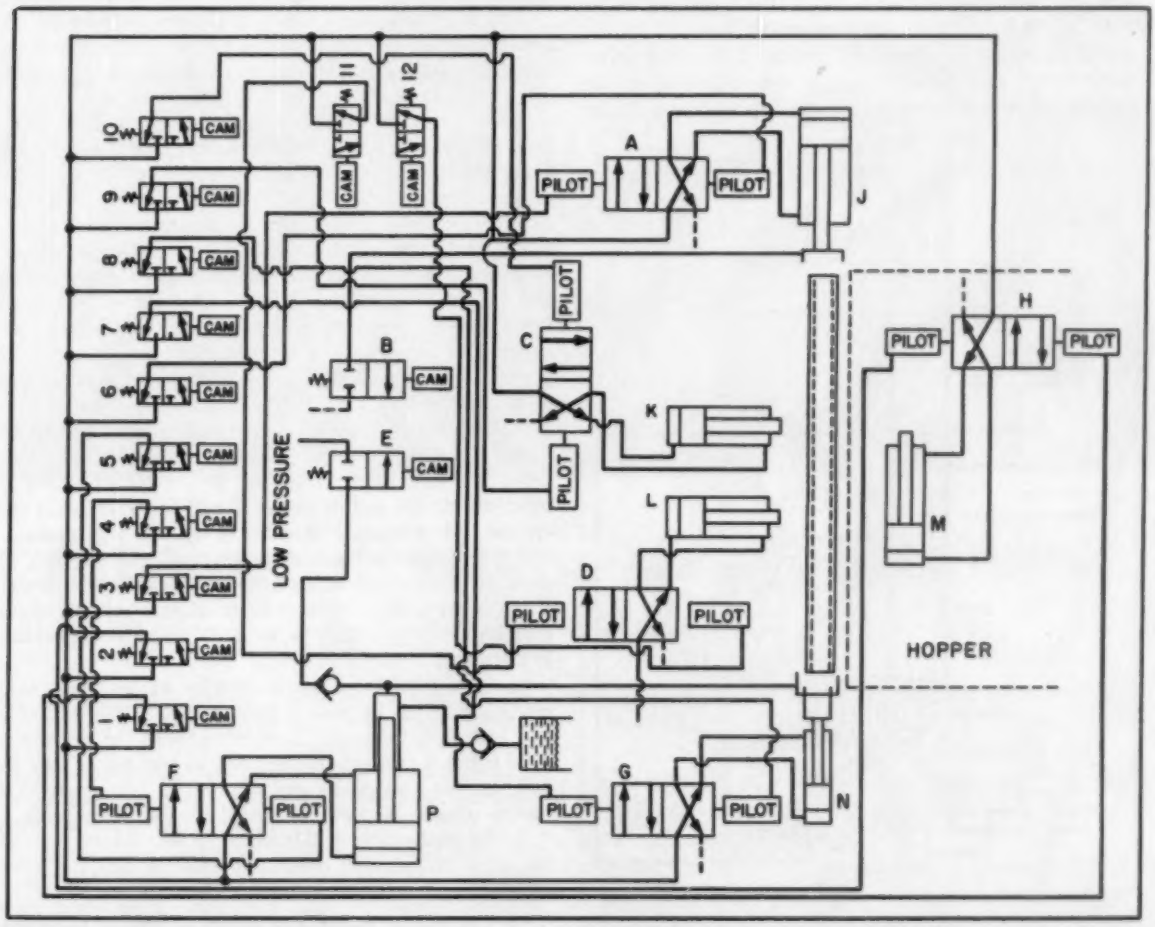



**Fig. 4. Circuit performs same functions as in Fig. 3, except valves are pilot-operated, electrical controls eliminated.**

the ends of tubes. If the tubes are held to close tolerances, an "O"-ring type seal often performs very satisfactorily. If the ends of the tube have any burrs, the seals may be cut and the high pressure fluid will cause excessive leakage. It may be possible to seal the tube on the ends if the ends are fairly square and if the cylinder that is doing the sealing is large enough to overcome the test pressure.

In this circuit we make use of an air-operated intensifier. Where excessively high-testing pressures are required, an hydraulic power device used in conjunction with the intensifier performs satisfactorily. This is recommended when 20,000 to 30,000 psi is required. In making the connection between the intensifier and test fixture, when extreme pressures are used, it is necessary to use special fittings to eliminate leakage.

In Fig. 4 we show a circuit which performs the same function as circuit shown in Fig. 3 except that pilot-operated valves are used and all electrical controls have been eliminated. This circuit is adaptable for highly explosive atmospheres or where excessive moisture is present.

The pilot-operated valves can even be operated under water as long as the exhaust is piped to atmosphere. While pilot valves require more piping than solenoid-operated valves, they are generally less expensive and are often more rugged.

In Fig. 5 we have a gaging operation in which the rejected pieces are automatically separated from the usable workpieces. This same circuit, or a variation of it, can be used for a sorting device or other similar applications.

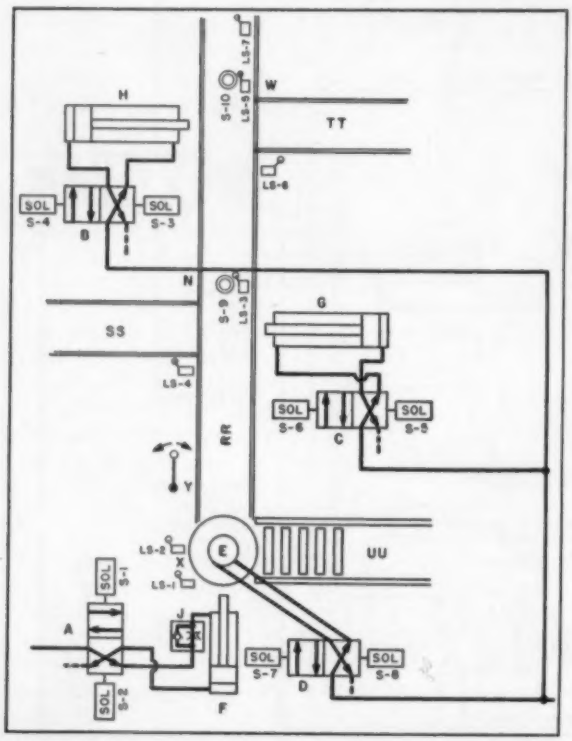



Fig. 5. Circuit for gaging operation in which the rejected parts are automatically separated from the usable pieces.

By using an automatic device the gaging can be accomplished without an operator. Such gaging is usually done on large transfer lines and may be spotted several places along this line.

In this circuit, the workpiece to be gaged moves down the power feed conveyor to positioning station X where LS-1 is momentarily contacted. This energizes solenoid S-7 of valve D and directs air pressure to actuator, E. Actuator fastened to conveyor section turns workpiece 90 degrees. As it does, LS-2 is momentarily contacted. This energizes solenoid S-1 of valve A and air pressure is directed to blind end of cylinder F. Piston of this cylinder advances at a speed set by flow control J and workpiece is pushed onto conveyor section RR. This is a power and feed type conveyor.

## Workpiece Moves Through Gaging Steps

Workpiece is then moved through gaging station Y. If the workpiece is beyond the high limit as it passes through this station, a limit switch is contacted which energizes solenoid S-9 and a block is thrown up between the conveyor rolls at station Z. If the workpiece is under the low limit, another limit switch is contacted, solenoid S-10 is energized and a block is thrown up between the conveyor roller at station W. If the workpiece meets the tolerances, neither limit switch is contacted and the workpiece continues on conveyor RR to the next operation.

When S-9 is energized and block moves up, LS-3 which is connected to S-9, is contacted by workpiece as it moves along the conveyor. This energizes S-6 of valve C and air pressure is directed to blind end of cylinder G. Piston of G advances and workpiece is pushed to gravity feed conveyor SS and is rejected. As piston of G reaches end of stroke, LS-4 is momentarily contacted, energizing S-5 and piston G retracts. On the outstroke of G, block raised by S-9 is returned to original position, clearing conveyor RR.

When S-10 is energized, block carrying LS-5 raises and as workpiece contacts LS-5, solenoid S-4 of valve B is energized and air pressure is directed to blind end of H. Piston H moves forward, ejecting workpiece onto conveyor TT and block raised by S-9 retracted. LS-6 is contacted at the end of stroke G and solenoid S-3 is energized. Air pressure is directed to rod end of H and piston H is retracted. Cylinders G and H and actuator D must all be in retracted positions before piston of cylinder F can be retracted. E returns to its original position whenever LS-4, LS-6, or LS-7 is actuated, and F retracts after E retracts.

In testing breaking points of wire, cables, rope, etc., air cylinders can be used to grip the end of the test piece and hydraulic force can be used to break the test piece. This is not a production operation as test pieces may be only one or two pieces out of 100 or 500 production pieces. Gages are used to record the breaking point.

In the final article of this series we will discuss some of the more complicated pneumatic systems that are being designed and used for industry. **End, Part XI**

**THERE ARE MORE EDITORIAL FEATURES STARTING ON PAGE 180**

# ALLIS-CHALMERS

Now — faster, easier hookup with new, 3-piece case design.

# All-new dry-type transformers

## ...on the wall, wired, closed in half the time!

**Now 35% smaller, lighter** — new Allis-Chalmers ventilated, dry-type transformers feature exclusive 3-piece case that cuts installing time from 90 to *just 40 minutes!* New, compact size opens additional installation site possibilities previously considered too tight for conventional units.

Noise level is reduced to no-hum, whisper-quiet operation by employing core impregnation... by isolating core-and-coil assembly from the case... and by use of nonresonate casing. Low core losses and low exciting current result from superior *Curvacore* construction.

This new 600-volt class indoor transformer line is available in 3- to 50-kva sizes for on-the-site load center applications where critical voltage must be maintained. And the price is right!

Further details are available in Bulletin 61B8222A at your nearby A-C office, or write **Allis-Chalmers,** Power Equipment Division, Milwaukee 1, Wisconsin.

Curvacore is an Allis-Chalmers trademark.

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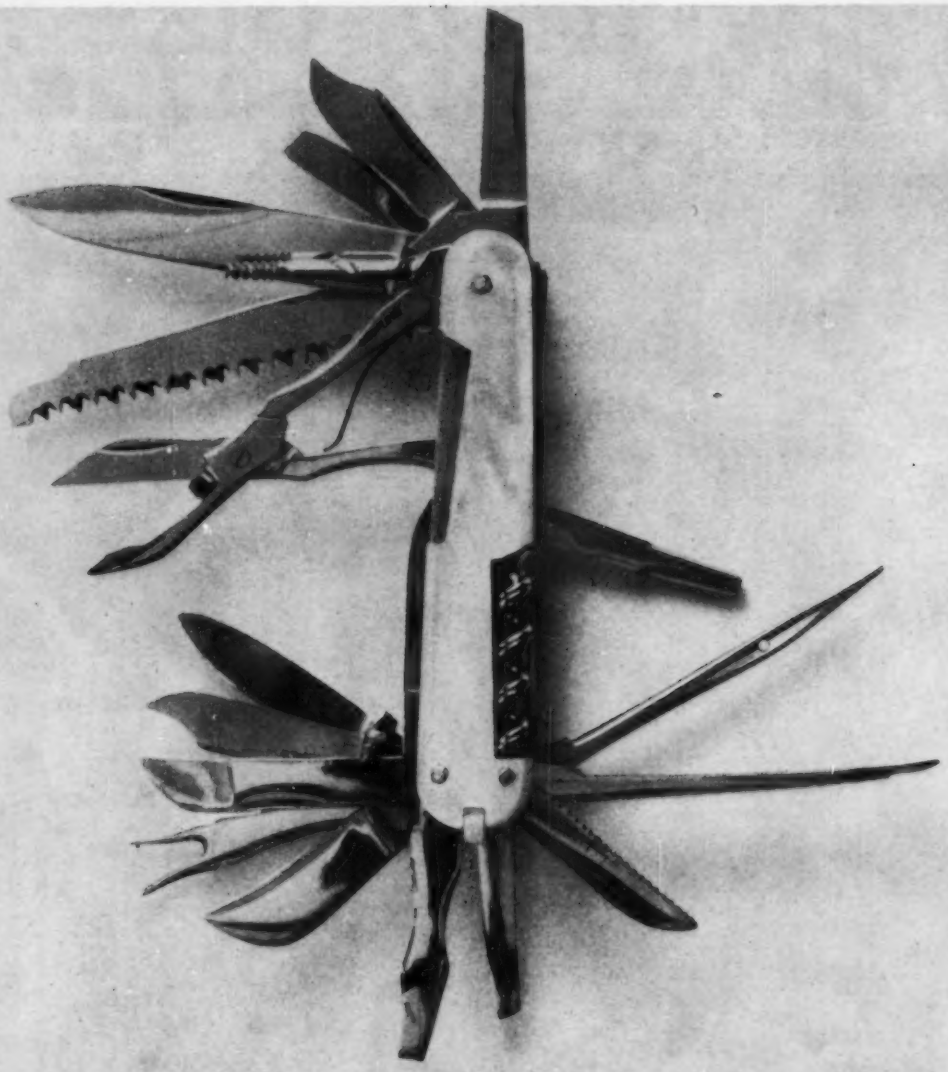

# VERSATILE

Here you see an ingenious collection of tools. Yet this superb combination knife cannot compare with INLAND 4-WAY SAFETY PLATE in versatility of performance. In fact, when it comes to describing the range of uses for easy-to-fabricate INLAND 4-WAY, there seems to be no limit.

Users tell us they especially like 4-WAY's versatility made possible by its 3 different raised-lug patterns—small, medium and large; by its 15 different gages from 18 gage up to ¾" thickness; by its range of weights from 2.4 pounds to 31.65 pounds per square foot; and by its availability in widths from 24" all the way up to 72". *For shop use, fleet maintenance, as a basic material in the fabrication of products, as a structural building material, 4-WAY is ideally useful. Write today for your copy of Inland's 4-WAY Safety Plate Booklet.*

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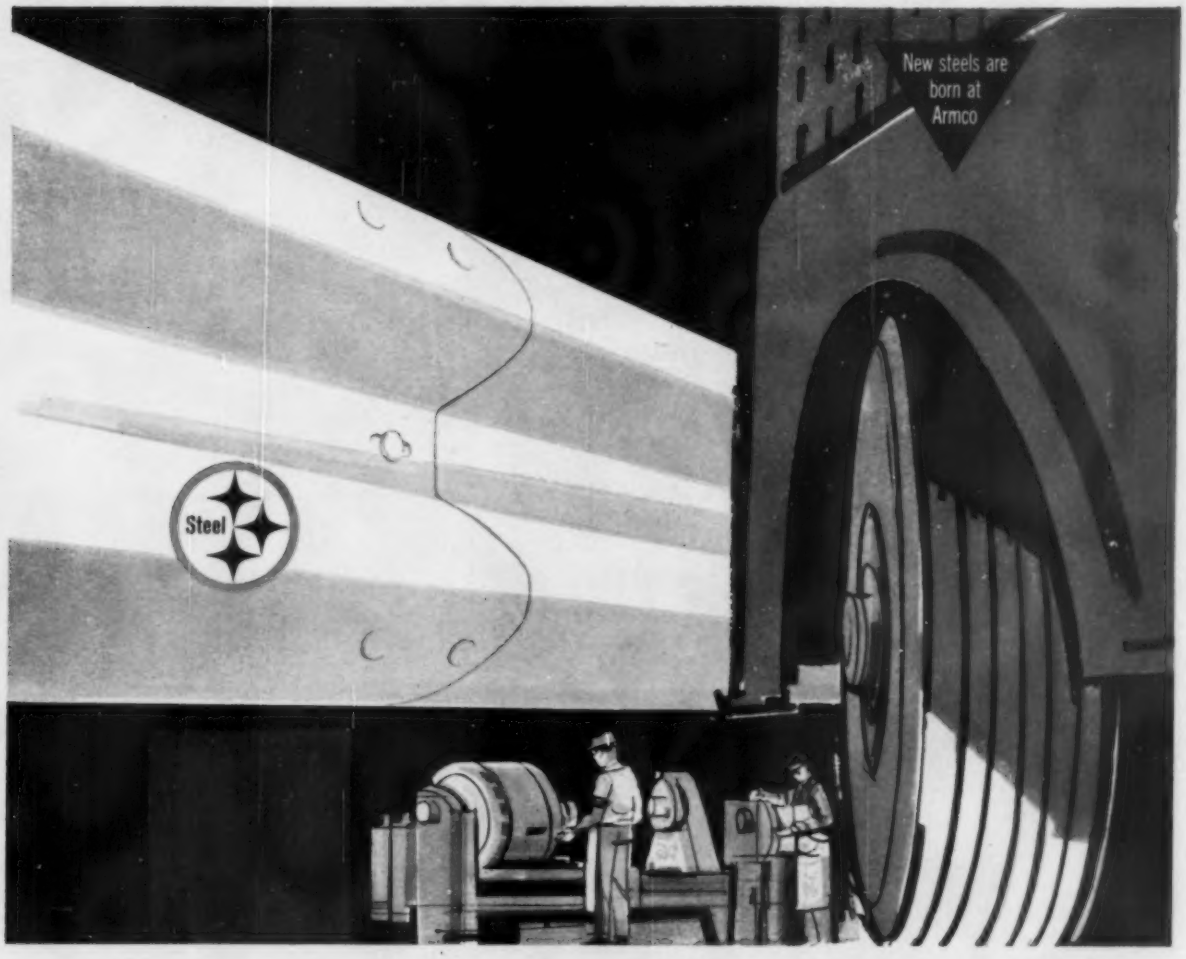


# ANNOUNCING A NEW GUARDRAIL MADE ESPECIALLY FOR YOUR PLANT TRAFFIC

**New Light-Gage Armco Guardrail Is Easier to Handle, Easier to Install**

Now you can get a special new Armco FLEX-BEAM® Guardrail for off-highway installations. Made of 16-gage galvanized steel, it weighs approximately 40 per cent less than highway-type FLEX-BEAM. The new, simplified splice requires only four bolts.

All in all, this new Armco Guardrail is lighter, easier to handle, easier to install. For the first time it provides the means for protection of plant property, parking lots, plant entrances, expensive machines and other key equipment, with a product especially made for off-highway service. You buy less steel to do the job. It's maintenance-free, too. This new light-weight Armco FLEX-BEAM is protected from rust by a durable hot-dip zinc coating.

**Get Details and Prices from your Armco Sales Engineer**

For full information write us. We'll arrange for the Armco Sales Engineer near you to provide the data you need. Armco Drainage & Metal Products, Inc., 7170 Curtis Street, Middletown, Ohio.

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*Subsidiary of* ARMCO STEEL CORPORATION

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# ATTRACTIVE APPEARANCE . . . SUPERIOR PERFORMANCE

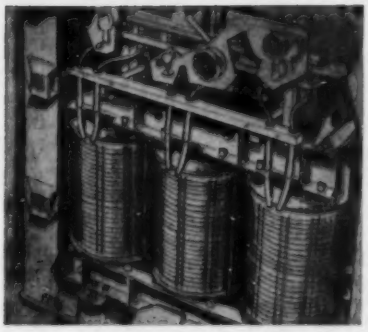
With Westinghouse unit substations, you always get ace-high performance. Switchgear and transformer are engineered as a unit—to work together for reliable, trouble-free service.

In addition, these quiet substations are good looking. Adaptable to small land plots, they are "good neighbors" in residential, commercial and industrial areas. Safe, too. Metal-enclosed construction keeps out unauthorized personnel, protects against external hazards.

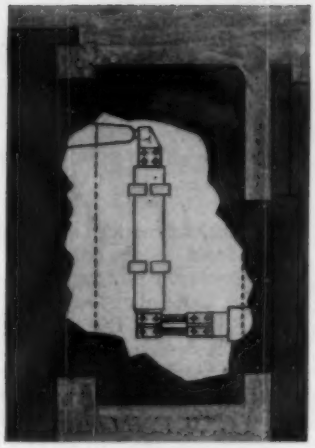
Installation is simple. Westinghouse unit substations are factory-coordinated, eliminating installation complications. They are shipped in sections . . . require only bolting together and connection of incoming and outgoing lines.

Call your nearest Westinghouse representative for all the facts . . . or write Westinghouse Electric Corporation, P.O. Box 868, Pittsburgh 30, Pa. You can be sure . . . if it's Westinghouse.

**Westinghouse**



TRANSFORMER FEATURES: *New Super Insuldur® Insulation System* enables transformer to handle 12% more kva load with no reduction in normal service life. • *Hipersil® Core* carries 1/3 more flux than ordinary electrical steel per unit area. • *De-energized Tap Changer* makes matching of line voltages quick and convenient when transformer is de-energized. • *Impulse Coordinated.*



BOX-TYPE THROAT CONNECTION includes provision to compensate for minor misalignment between transformer and switchgear as a result of foundation differences.

SWITCHGEAR FEATURES: *DH Magnetic Air Circuit Breakers*, with De-ion® arc interruption, assure superior circuit protection. • *Horizontal Drawout DH Breakers* permit ease of inspection, maintenance and breaker interchange. • *Limitrak® Insulation System* provides balanced insulation protection with superior nontracking characteristics. • *Shelterfor-M® Design* furnishes roomy, protected aisle space for personnel and equipment for inspections, maintenance or breaker interchange under all weather conditions.

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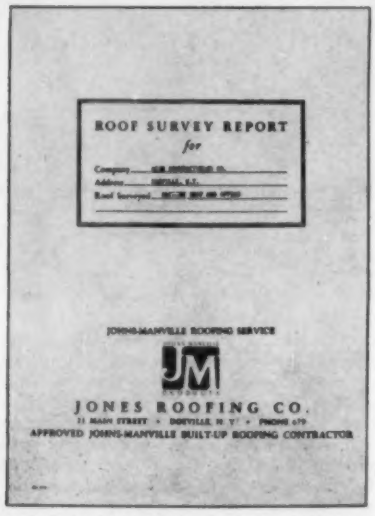
# What these trained eyes see may save you thousands of roofing dollars!

YOUNG ROOFING CO., ST. LOUIS, MO.




**ABSOLUTELY WITHOUT OBLIGATION—** *a detailed report like this covering your roof and what it needs now or later.*

*Let a Johns-Manville approved roofing contractor make the report for you... without the slightest obligation*

It takes a practiced eye to spot roof troubles that may cost you thousands of dollars later. The approved Johns-Manville Roofing Contractor near you can locate trouble before it happens . . . and knows what to do about it.

A J-M Roof Survey—available to you without obligation—covers visible defects. More important, it points out future troublesome spots. And it shows you clearly and concisely what to do and what it will cost using quality Johns-Manville Roofing Products . . . and the services of your J-M contractor.

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JOHNS-MANVILLE

J-M 7★ 7 STAR VALUE PRODUCTS

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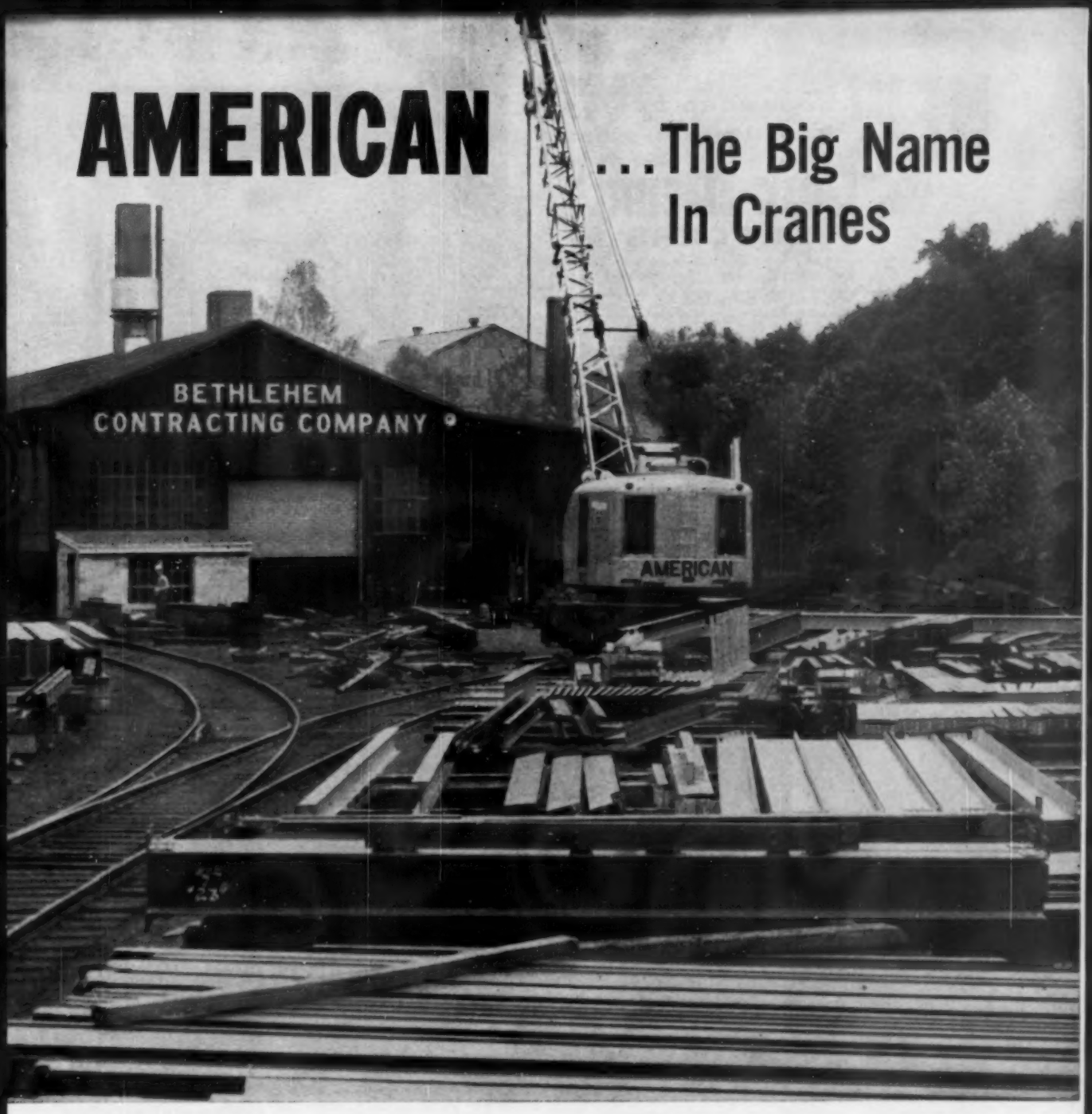
# AMERICAN ...The Big Name In Cranes




Write for detailed, illustrated information showing how versatile American Truck and Crawler, Self-propelled and Locomotive Cranes (American DiesELectric,® above) are engineered to give you trouble-free, high volume materials handling service.

**AMERICAN HOIST**
and Derrick Company
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EXCAVATORS-CRANES to 2 yds.-60 tons
LOCOMOTIVE CRANES to 130 tons

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REVOLVER CRANES to 400 tons

CROSBY-LAUGHLIN DIVISION
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the most durable . . . available today at no extra cost

NEW **SELF-ACTUATED PAIL REST**

opens and closes automatically by simple lever device—on all step-ladders equipped with pail rests

NEW

- No nails—tie rods pass thru step grooves or recessed knee braces for stronger, longer-lasting support on Tioga, Samson, Utility, Electric, Underwriter Stepladders

NEW

- Heavy gauge top iron wraps around ends of top piece for extra strength—on Tioga, Samson, Utility and Electric

NEW

- Non-split, two-piece top riveted to iron support of Tioga, Samson, Utility, Electric

These four exclusive design features of "Gold Medal" Step Ladders are truly functional, and are not gingerbread. They were adopted after considerable study, with the sole purpose of making famous "Gold Medal" Step Ladders even more durable.

Flush step construction, a plus feature incorporated about two years ago, is another example of the constant search for ways to improve "Gold Medal" Ladders for every purpose, with top quality in every price range.

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*FOR GREATER SAFETY...EFFICIENCY...ECONOMY*

GOLD MEDAL LADDERS SCAFFOLDING

**THE PATENT SCAFFOLDING CO., Inc.**

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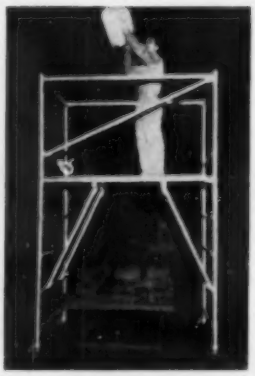
# Aluminum Rolling Scaffolds Raise Efficiency -- Lower Costs

Preventive maintenance is an economic necessity which accounts for millions of dollars of savings in equipment and materials each year. It can be costly in time, labor and life. However, when the job calls for getting off-the-ground . . . there's no safer, more economical way than with PS Co.'s Aluminum Stairway Scaffolds. Scientifically designed, they are available in two basic styles. Aluminum Sectional Scaffolds are erected from separate frames, braces and stairways. All sections of "Fold-A-Way" Scaffolds fold into compact units. Base dimensions of both types are 4'6" x 6'. Sectional Ladder Scaffolds can be 29" or 4'6" wide in lengths up to 10'.



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for Aluminum Sectional and "Fold-A-Way" Scaffolds increase vertical clearance at center of platform to 8' 9½". For 29"- and 4'6"-Wide Ladder Scaffolds clearance is 8'4".

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Doesn't it make sense to insist on Visible Blade construction which gives you a road block against any of those possibilities? Doesn't it make equally good sense to insist on the safety switch which gives you that construction—plus a lot of other performance advantages? Evidently it does, because *Square D switches have never been out of first place in more than 50 years!*

They cost no more...why settle for less?

SQUARE D COMPANY

*wherever electricity is distributed and controlled*

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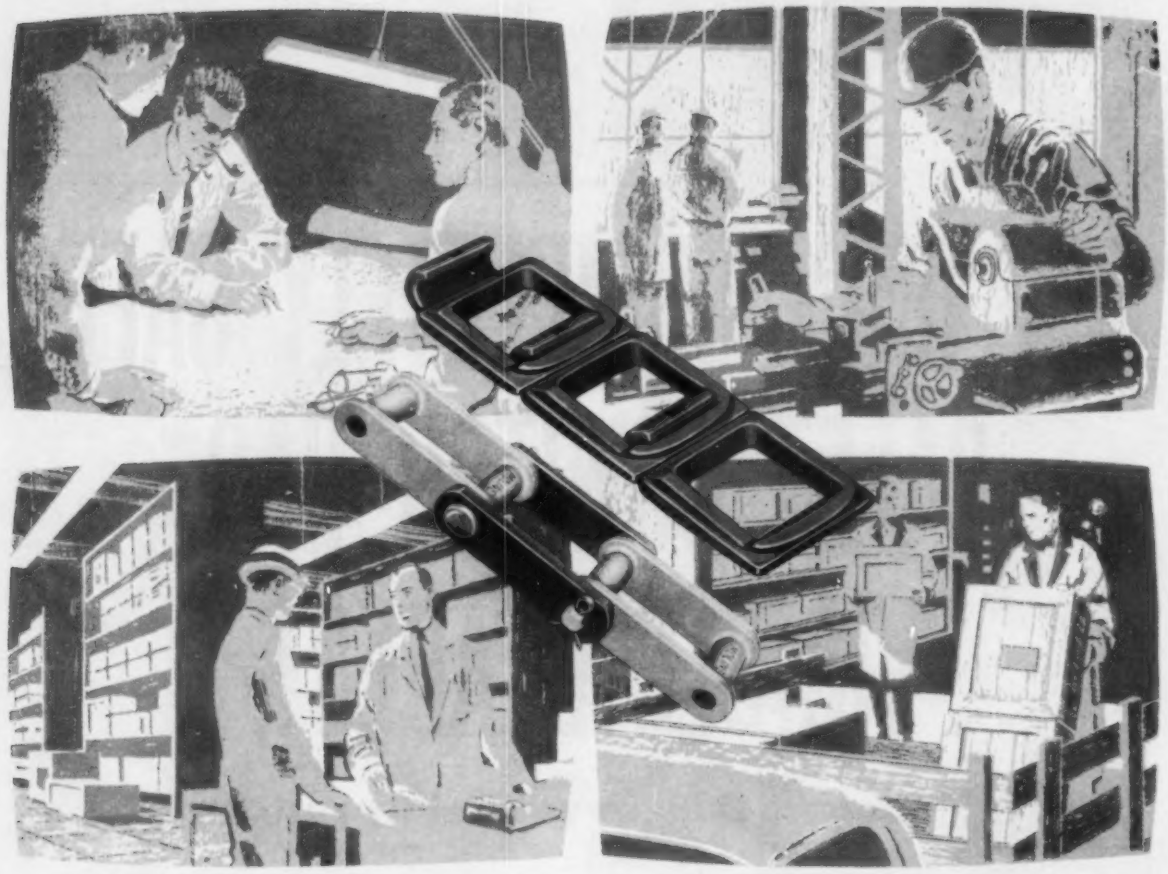

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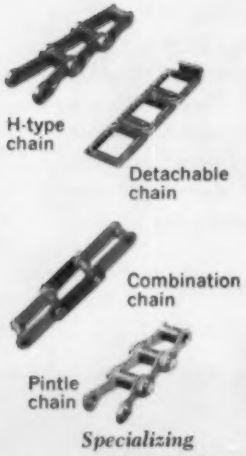


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Your Moline Chain distributor offers much more than just a source of supply. His is a "local service business"—and he has the engineering experience and know-how to help solve your problems. He has also a crew of technical men—machinists, gear cutters, installation and maintenance men—to give you special service. And he carries a tremendous stock—as many as 7000 items—virtually any item needed for efficient power transmission.

You can depend upon *fast service* too, so call your Moline Chain distributor today!

# Moline Chains

**Leaders for 60 years**

***for conveying, elevating and power transmission***

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# One good Le Roi leads to another ...user reports

One of the machines served by the Le Roi 75S2 is the rivet drilling machine. The operator is shown gauging one of the drilled tubular rivets prior to finishing.

# LE ROI 75-HP STATIONARY COMPRESSOR

**First air-cooled Le Roi finishes 5 years of service with just routine cleaning and oil changes!**

Shown above is a Le Roi 75S2 compressor recently installed at John Hassall, Inc., Westbury, Long Island, manufacturer of job-designed fasteners and parts.

Picking Le Roi came naturally when Hassall found need for additional air power. Their last Le Roi has worked for five years without trouble, and has required only filter cleaning and oil changes for upkeep.

Hassall was convinced they could save 30% on installation, get more air from less space, and reduce maintenance time about 40% if they installed the air-cooled Le Roi 75S2 rather than a water-cooled air compressor.

Moreover, Le Roi compactness permits installation *near the point of use*, with less piping and air loss. Air-cooling eliminates costly plumbing and water-line freeze-ups... permits indoor or outdoor installation. Dual control gives you constant speed or automatic start-stop operation.

Pick Westinghouse unit-type or Le Roi stationary air compressors for your needs. Sizes from ½ to 100 hp. See your Le Roi distributor, or write to Le Roi Division, Westinghouse Air Brake Co., Sidney, Ohio.

SC-67

**LE ROI STATIONARY COMPRESSORS**

PORTABLE AND TRACTAIR® AIR COMPRESSORS • STATIONARY AIR COMPRESSORS • AIR TOOLS

**For more facts circle 595 on Reply Card**

Oil distribution setup which consists of reversible turbine type oil pumps, filters, and valves to distribute the oil from storage tanks to the test floor.

# "ON TAP" PLANT SERVICES

## SUPPLY AIR, WATER, GAS, OIL TO POINT OF USE

By T. A. McDOWELL, Plant Mechanical Engineer, Westinghouse Electric Corporation

ALL POSSIBLE fluids are distributed at the Power Circuit Breaker plant at Trafford, Pa., directly to the work areas from central systems through pipelines.

At each piece of equipment or work station there are necessary service lines—overhead, underground or in trenches—that deliver the air, water, gas, oil, cooling water, etc., to the work area at the pressure and quantity required. This was done to eliminate the handling of gas bottles, oil drums, paint drums and long lengths of portable hose lines.

Preliminary layouts were made by the layout engineers to determine the total required floor area in the new building. Then the general areas for manufacturing, testing, storage and shipping were allocated. Approximate quantities of the various fluid services required in each area were determined and recorded on a general layout drawing.

The layout drawing with the approximate fluid requirements was given to the plant engineering department to lay out a distribution system. As a guide in planning the fluid distribution, the Power Circuit Breaker division had established a policy of using central systems and pipelines for distribution where practical.

After considering the requirements of the new plant, the plant engineering department selected the source of supply and laid out a system of main lines.

However, in order to lay out the branch lines to the various pieces of equipment it was necessary to have detailed layouts. Layout engineers with the help and approval of operating supervisors made detailed three-dimensional scale model layouts of each section. All service line outlets required to operate the machines were accurately located and marked by identifying symbols on the layout.

Each section of the layout was photographed and prints were made which could be scaled to determine the location of pipe outlets with respect to the machines and building columns. These prints were used by the plant engineering department to lay out a network of pipes under the floor to supply the required fluid services at the exact location needed for future installations of a machine or work station.

Foundations were installed and the concrete floor was poured through most of the building with the pipes under the floor and hundreds of capped outlets extending three to nine inches above the floor. Machine tools, process equipment, conveyors, and work stations were installed throughout the seven, 60-ft wide by 550-ft long aisles with the necessary service lines already in place at the floor line or in the foundation.

The dozens of outlets of 90 psig air, high and low pressure steam, city water, hot water, and natural gas were

This 90,000-cu ft oxygen supply tank with an atmospheric vaporizer supplies oxygen at 140 psig for use in the plant.

Here is a typical column showing the outlets for distributing various fluids in the plant.

supplied from our Trafford powerplant or existing underground main utility lines. Circulating cooling water supply and return lines were connected into an existing forced draft cooling tower which had sufficient capacity to supply the needs of the building. In addition to these normal services there are special bulk distribution systems installed in certain areas of the building.

Large amounts of transformer oil are required in the manufacture and testing of circuit breakers. To supply this requirement eight vertical oil storage tanks with a capacity of 100,000 gallons are installed on a concrete foundation pad about 75 ft from the main building. Three four-inch diameter lines are installed from the storage tanks to three reversible turbine type oil pumps on two test floors. An additional four-inch line goes directly to a 12,000-gallon storage tank in an oil impregnating setup pit.

On the large oil circuit breaker test floor, there are branch lines with 12 remote control stations from which test personnel can operate the pumps to fill or empty a circuit breaker on test. The oil is normally supplied through one four-inch line and returned through another, although it can be pumped in both directions through the same line.

Oil can be removed from any one of the eight tanks and returned to the same tank or any other tank depending on which manually-operated valves are open. Since the oil accumulates dirt and moisture as it is used for testing, it can be pumped from a storage tank through a filter press and centrifuge to a clean oil tank.

The test floors also require large quantities of 350 psig and 175 psig compressed air to test air-actuated circuit breakers. This air is supplied by five, 1000-psig air compressors each rated at 62 scfm. The 1000 psig air is stored in five, 39-ft long high pressure air cylinders from which it can be withdrawn at a rate of 2500 scfm when needed to fill a breaker.

The air is filtered and reduced to 350 or 175 psig, then distributed to three test floors through underground main lines. At each test floor it is distributed through branch pipelines to supply 22 recessed outlet stations.

The plant is set up to burn out, assemble and weld tanks for circuit breakers. This requires two large burnout machines and 51 outlets for hand burning. The burning is done with 15 psig natural gas which comes

(Continued on page 251)

Liquid argon cylinders are connected to gas proportioner which mixes argon and oxygen for inert atmosphere used at some of the plant's 38 welding stations.

# PACKAGE UNITS, FREE AIR RETURN CUT AIR CONDITIONING COSTS

By P. BONEY, Air Conditioning Division, Westinghouse Electric Corp., Staunton, Va.

ELECTRONIC COMMUNICATIONS, Inc.'s new 150,000 square foot manufacturing building in St. Petersburg, Florida will double the company's production capability in the fields of electronics and electromechanical products which are vital to the national defense. Air conditioning will play an important part in maintaining the quality of the company's products.

The manufacturing area is conditioned by six water-cooled package units each with a cooling capacity of 50 tons. The units are located in the center of the building above the area used for employe rest rooms. The flexibility of the units, Westinghouse L4 types, made it possible to side mount the fan sections and discharge horizontally into six separate zones. The air is ducted to the perimeter of the building and drawn back to the equipment area without the employment of return ductwork.

"Free return" reduced the ductwork price by several thousand dollars and resulted in the most economical system possible while still allowing the flexibility of zone control. The use of separate units permits certain areas of the plant to be conditioned without operating the entire system thus reducing operating costs. This was an important consideration since certain areas of the

**Fig. 1. Manufacturing area is served by six 50-ton package units located above rest rooms in center of plant. Note that a separate 50-ton unit serves the cafeteria while three more units are employed to air condition the office area.**

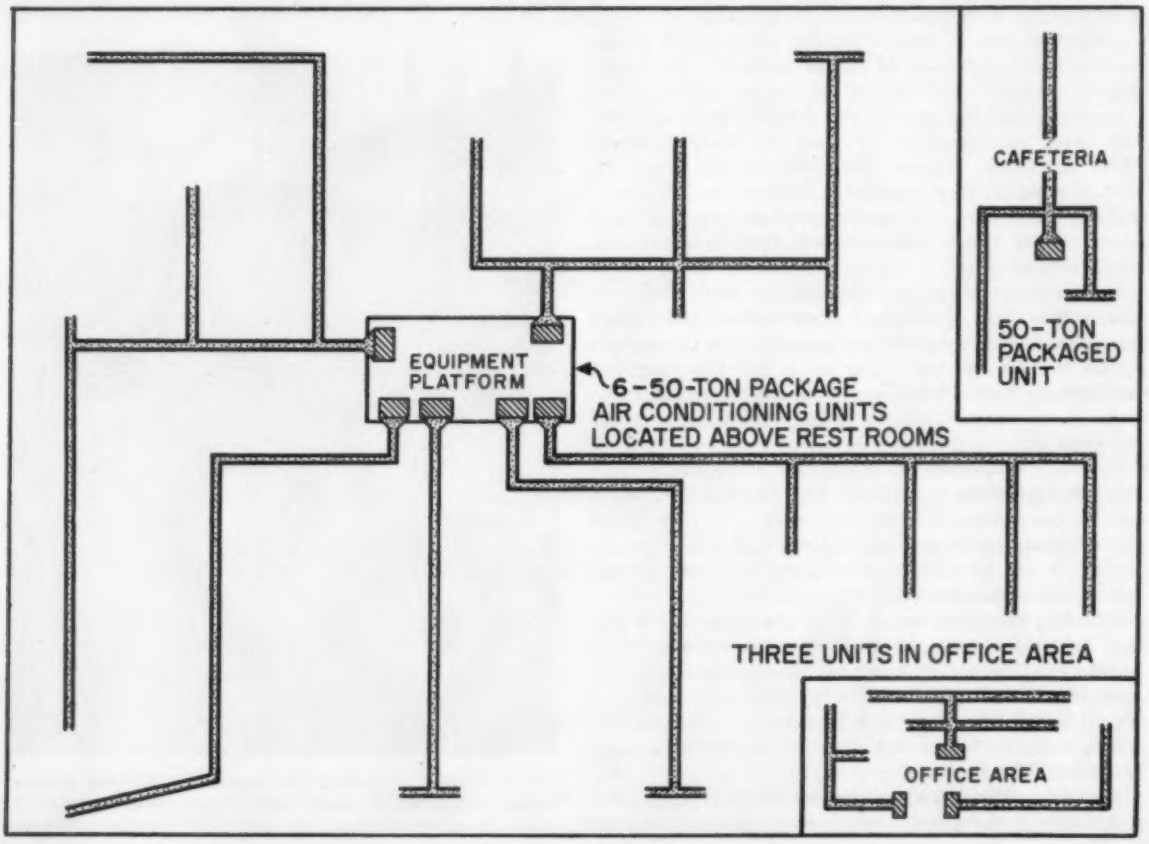


Fig. 2. View on platform above rest rooms shows motorized damper arrangement to control fresh air intake.

Fig. 3. Below: Side view of unit shows side-mounted fan section, condenser water piping and condensate drain piping, and motorized damper arrangement located on rear of unit.

plant will be used more than others during peak production periods on electronic components for the Armed Forces.

Proper humidity conditions are maintained by the introduction of fresh air through the roof and ducting this air into the rear of each unit. Automatic dampers connected to the rear of each unit control the mixing of the air entering the units. The heating system consists of electric blast coil heaters mounted in each of the package units.

Cafeteria area is served by an additional 50-ton package unit which is connected to the same 350-ton cooling tower that serves the manufacturing area. The tower is located adjacent to the rear of the building.

Water pressure switches are installed in each unit and will not allow the compressor to operate unless the pump is handling water at a pressure sufficient to close the water safety switch. An economizer head pressure and water temperature control thermostat maintains the water temperature within the condenser water system at a maximum of 85 deg by cycling the cooling tower fan.

The hermetic compressor in each unit is controlled by a room-type thermostat located in the zone being cooled by the unit. The first stage of the thermostat loads the compressor to 50 per cent capacity, and on a call for additional cooling, the second stage of the thermostat loads the compressor to 100 per cent capacity. The fan motor control circuit is also interlocked to prevent the compressor from operating unless the fan motor is running.

Each unit is equipped with an economizer control system which automatically operates fresh air and return air dampers to their correct positions depending on the mixed air temperature entering the unit.

## Heating Cycle

Electric blast coil heaters are in two stages and are operated from a room-type thermostat adjacent to the cooling thermostat in each particular zone. Two-stage heating thermostats are used giving step control of the heating system and reducing operating costs. Unit fan motors are electrically interlocked to prevent the heaters from operating unless the fan is running. A high temperature safety cutout is also installed in each unit to disconnect the heaters in the event of excessive temperature.

Office area of the new building is conditioned by three units. Each of these units is used in conjunction with Westinghouse type BU air cooled condensers. This area is also heated by the use of electric blast coil heaters mounted in each of the units. The use of multiple package units permits zone control of the various office areas without energizing the entire system.

Power requirements of the local utility resulted in the stipulation that the air conditioning and heating equipment operate on 480 volt service. All of the hermetic compressors and fan motors were wound for 480 volts to meet this requirement.

This ultramodern plant is an example of what can be accomplished by careful planning of air conditioning requirements. The use of large package units resulted in an installed cost that was considerably less than a central air conditioning system. At the same time, the package units permitted the utmost in flexibility and reduced operating costs. **End**

News from the Plants

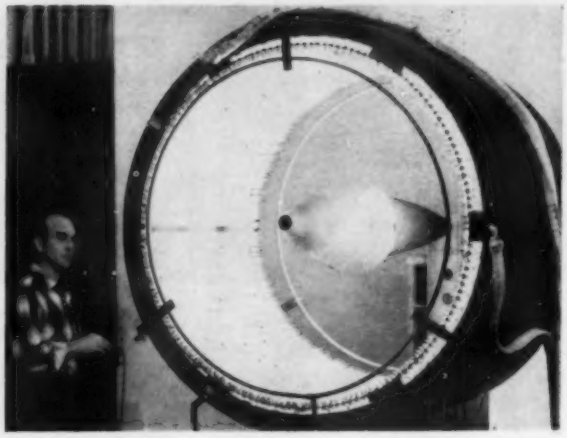
## Quartz Infrared Lamps Provide High Temperatures for Space Research

THE THERMAL BARRIER, a major obstacle to space travel, is being overcome with the aid of a modern version of the common light bulb. It is a tubular, pencil-thin quartz infrared lamp, capable of producing the intense concentrations of energy required to simulate heating conditions when a space vehicle enters the earth's atmosphere.

Temperatures of more than 3000 F., about one-third the temperature of the sun's surface, are being created in closely arrayed banks of the tubular lamps in over-voltage operation, according to General Electric's Large Lamp Department.

Fast heating and cooling characteristics and low thermal capacity of quartz infrared lamps make them a most satisfactory device for thermal barrier simulation. Temperatures in this work must be varied rapidly and controlled accurately to produce the same temperature conditions that missiles would develop in passing through various regions of the atmosphere.

The maximum wattage a quartz lamp can withstand is determined by the melting point (about 1600 F.) of the tungsten filament. Lamps designed to operate at 200 watts per inch have been operated, however, for a few seconds at 1000 watts per inch. A new lamp General Electric now has under development is designed to operate at 360 watts per inch, but is capable of operating as high as 1500 watts per inch for very short periods.



Operating life of quartz infrared lamps of the type used in aircraft and missile structure testing has been recently improved by using platinum lead-in wires. While oxidation causes the standard seal with molybdenum wires to break down at 650 F., the new seal will last for 100 hours or more at temperatures around 1500 F.

## Explosive Charges Exert Hydraulic Pressure To Form Metal Shapes

METALS THAT ARE either too tough or too brittle to form by conventional methods are literally being exploded into shape in several plants. In one application, dished heads, 54 in. in diameter (for use on the Polaris missile) are given their final contours in a specially-designed explosive die, at the Edwardsville, Ill., plant of Propellex Chemical Div. of Chromalloy Corp.

Each head, made of high-nickel, low-chrome alloy steel, is hot-preformed. Without stress relieving or annealing, the head is loaded into an open die. The die is then filled with water, and carefully-designed explosive charges are placed in strategic locations in the die.

When the charges are set off, the uniformly high, instantaneous hydraulic pressure shapes the head to the contour of the die.

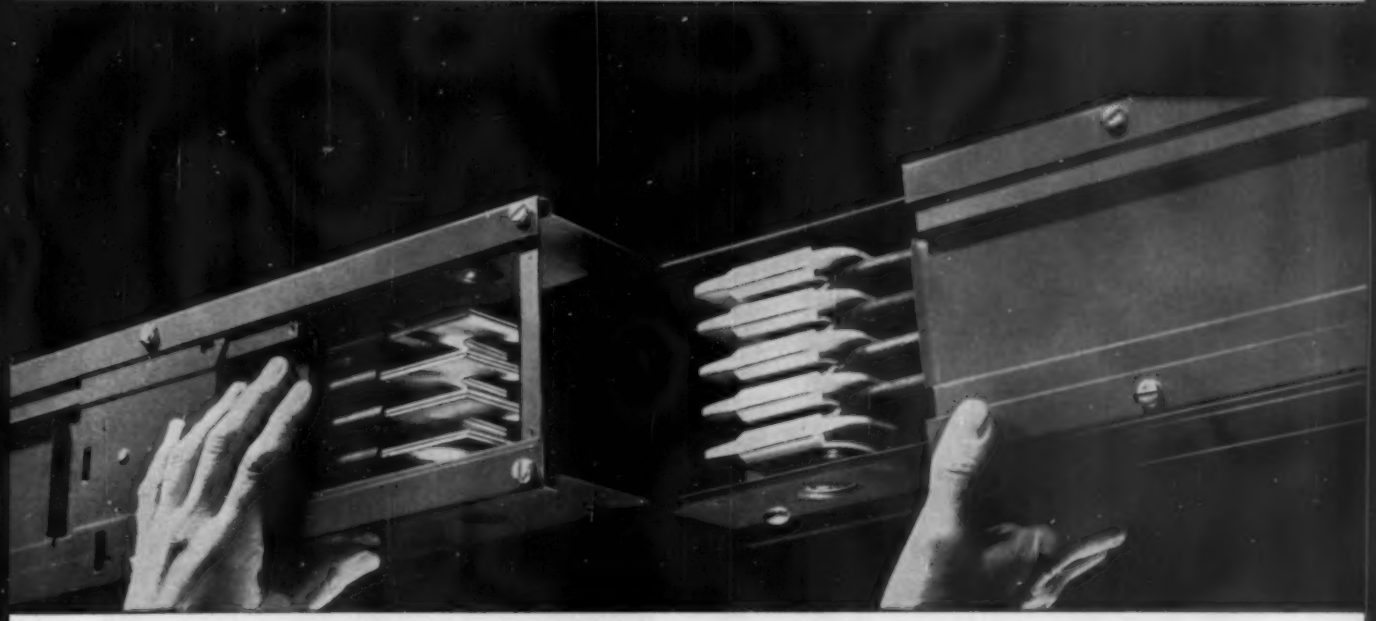
## Stainless Steel Calciner Takes Heat, Chemical Action In Stride

A NEW UNDERTAKING to profitably reduce lime-laden copper ore is placing stainless steel in an important role. A salt coke segregation process is being developed to reduce the ore, which has economically defied more conventional ore reducing methods.

For the first time, indirect-fired equipment will be used in the salt coke process, in equipment designed and built by Standard Steel Corp. A vital part of the equipment is a cylindrical stainless steel vessel, 48 ft. long and 54 in. in diameter. It is a rotary calciner, operating in a gas-fired furnace at temperatures up to 1500 F.

Hard-to-process copper ores are broken down in the calciner, fabricated of Allegheny Ludlum stainless steel. Stainless retains its strength and resists oxidation at the high temperatures at which the process is carried out.

The salt coke process feeds crushed ore, along with coke and a halide salt, into the calciner, where it is mixed and heated. The reaction produces metallic copper in the mix, which is sent through a cooler, into a ball mill classifier circuit, then to flotation cells for concentrating of the ore.



## NEW BULLDOG XL BUSTRIBUTION DUCT

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You can install XL BUStribution® Duct easier, faster than any other duct because of these exclusive new design features . . . plated aluminum bus bars with KEYED ENDS slip together fast, align automatically for proper position. There's no fumbling and fitting . . . ONE INTEGRAL BOLT tightens fast, locks joint positively under a ton of pressure. Bolt tightens against bus bar, not against the casing . . . TEN-FOOT SPANS take fewer hangers and less time to install than ordinary duct.

New XL BUStribution Duct is 3 ways safer, too. It's the only true dead-front duct, the only one with exclusive Safety Door, the only one with Safety Plug. And it reduces duct weight on building structure as much as 40%. Ask your BullDog representative to arrange for a demonstration . . . you'll see how fast to install and how safe new XL BUStribution Duct really is.

BullDog Electric Products Division, I-T-E Circuit Breaker Company, Box 177, Detroit 32, Michigan. In Canada: 80 Clayson Rd., Toronto 15, Ont. Export Division: 13 East 40th St., New York 16, N. Y.

SINGLE INTEGRAL BOLT puts a ton of pressure on keyed bus ends. Joints lock tight *fast*, stay locked.

TEN-FOOT SPANS take fewer hangers and less time to install than ordinary duct.

**BULLDOG ELECTRIC PRODUCTS DIVISION**
**I-T-E CIRCUIT BREAKER COMPANY**

KEEP PACE ELECTRICALLY

**For more facts circle 596 on Reply Card**

## "Baby" Cyclotron Installed In College Lab for Nuclear Courses

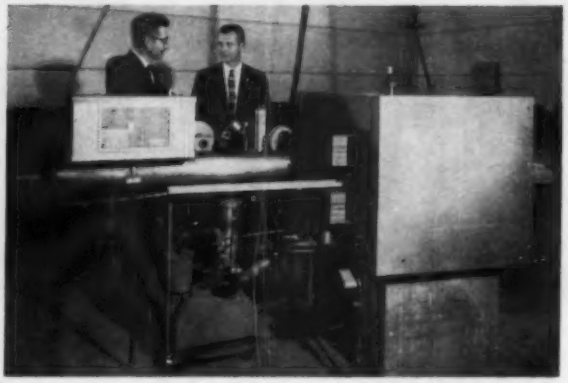
A COMPACT CYCLOTRON no larger than an office desk was recently unveiled at Pomona College, Claremont, California. The small atom smasher, built by Hughes Aircraft Co., is the first cyclotron in the nation designed and maintained strictly for undergraduate instructional purposes.

The machine is capable of producing either protons of 2 Mev (million electron-volts) energy or deuterons of 4 Mev energy at currents up to 25 microamps. It uses an oscillating radio frequency potential to accelerate positively charged particles between two semi-circular electrodes, and a large electromagnet to constrain the particles to circular paths which increase in radius as the particles gain energy.

Vacuum pumps, control valves and a five-foot coaxial feed line for supplying acceleration energy make up the cyclotron's "plumbing" while an iron-block electromagnet, mounted on concrete supports, contains semi-circular vacuum tanks in which the particles are accelerated.

Targets are exposed to the cyclotron's proton beam by inserting them through a one-inch valve on the front of the vacuum tank. The machine also has provisions for installing a deflection electrode to extract the beam from the vacuum tank so that large targets can be exposed.

All electrical and electronic circuits are controlled by magnetic amplifiers. The cyclotron draws approximately 11 kva of power at either 220 or 208 volts, three phase. It measures approximately three feet by five feet and weighs seven tons. Practically foolproof, safetywise, three interlocks on its door make it impossible to operate unless the door is properly secured.



## Automation Goes In Circles To Drill, Ream and Tap Auto Parts

A NEW CAROUSEL-TYPE machine performs all the drilling, reaming, counterboring and tapping operations on two different flywheels for a major automobile manufacturer. Core of the machine is a seven-position rotary table surrounded by six machining units and one loading and unloading station.

Each flywheel is fastened vertically against the table side by a precision collet which expands through the center hole in the flywheel. As the table indexes, multiple spindle and single spindle drill units advance and drill 40 holes, ream 14 and counterbore and tap six. Pushbutton controls enable the operator to select the operations necessary to machine either of the two flywheels.

National Automatic Tool Co., Inc., designed and built the unusual machine in circular automation form to simplify the handling problem posed by the workpieces.

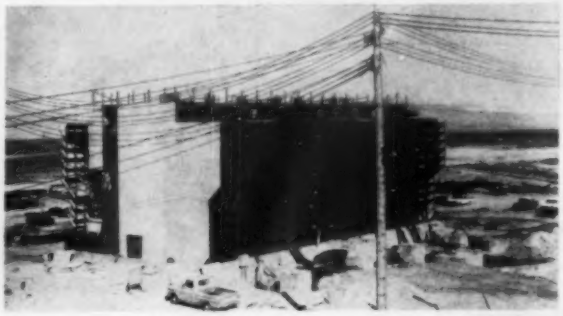
## Big Fans for a Big Cooling Job at Atomic Reactor Test Station

FOUR OF THE WORLD'S largest cooling tower cells, combined to form a unit capable of handling 24,000 gallons of water per minute, have just been completed for the AEC National Reactor Testing Station near Idaho Falls, Idaho. The unit was designed and built by Slough-DeFlon Co., to cool recirculated turbine condenser water for the EBR II (Experimental Breeder Reactor) nuclear project.

The tower is 100 ft long, 60 ft high and 65 ft wide; it is equipped with four 14-ft high-velocity recovery stacks. Four six-bladed aerodynamic fans within the stacks displace nearly one million cubic feet of air each, at a horsepower expenditure of less than 75. The 150,000 board feet of redwood lumber used in the tower was pressure treated with Koppers Erdalith salts for permanent protection against micro-organisms which ordinarily cause decay in the hot, humid conditions occurring in the cooling tower.

The 22-ft-diameter fans, largest made in this country, were furnished by the Metal Products Div., Koppers Co., and were especially designed to move the maximum quantity of air with the minimum of expended horsepower. The fans are operated as induced draft, drawing the air through the louvers at the sides of the cooling towers and through the falling water in the tower.

Most of the tower itself is of redwood, pressure-treated for protection against fungus and termite attack. The lumber was treated by the Koppers Wood Preserving Div.



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# NEW PLANT CONSTRUCTION —advance information on location costs

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**San Fernando, Calif.**—Anheuser-Busch, Inc., 721 Pestalozzi St., St. Louis 18, Mo., plans major addition to company's facilities here. Company has awarded contract of $4.5 million to Del E. Webb, 1501 W. San Fernando Rd., Los Angeles 39, California.

**Miami, Fla.**—Miami Herald Publishing Co., 200 S. Miami Ave., this city, plans to construct a newspaper plant at N. E. Bayshore Place and Thirteenth Street, this city. Plant will be a multi-story structure of steel and concrete and will be erected by Gust K. Newburg Construction Co., 99 N.E. 71st St., Miami, who has just been awarded a construction contract of $10 million. Work on the structure is already under way and is scheduled for completion in the spring of 1962. Total cost of the project will be $14.5 million.

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**Skokie, Ill.**—G. D. Searle & Co., P. O. Box 5110, Chicago, Ill., will spend more than $6 million in expanded facilities over the next two-year period. Included in the expansion will be additional warehousing facilities and research facilities at plant located here, and expansion of manufacturing plants of company's English subsidiaries.

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**Webster, N. Y.**—Haloid-Xerox, Inc., Rochester, N. Y., has construction under way on a new plant here where company will manufacture powders used in its document copying machine. Work on the new plant, already under way, is scheduled for completion by June of 1961. Company has recently acquired a 232-acre tract adjacent to company's present 180-acre site on which the plant of 26,000 sq ft will be erected. Cost will be about $1 million.

**Anderson, N. C.**—Clark-Schwebel Fiber Glass Corp., an independent affiliate of M. Lowenstein & Sons, Inc., plans to construct a glass weaving and finishing plant on a 20-acre site located here. New plant will have a floor area of 160,000 sq ft with ample room for more than 400 looms. Work on the structure is already under way and is scheduled for completion the early part of next year. Plant and equipment will cost about $3 million when completed.

**Charlotte, N. C.**—Florida Steel Corp., Tampa, Fla., plans to construct a steel furnace and rolling mill in this area. Plant when completed will be integrated into the operation of Easterly & Mumaw, Inc., a North Carolina steel fabricating and distributing company, whose merger with Florida Steel was approved recently by Florida Steel Corporation's stockholders.

**Raleigh, N. C.**—Corning Glass Works, 1946 Crystal St., Corning, N. Y., plans to build a plant near

(Continued on Page 247)

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**Camden, N. J.**—Monsanto Chemical Company, 1700 S. Second St., St. Louis, Mo., plans to construct a phthalic anhydride and phthalate ester plasticizers producing facility 20 miles southwest of this city.

**Newark, N. J.**—P. Ballantine & Sons, Inc., plans major construction and expansion program of company's facilities located here. Work will get under way at once and will be completed by the first quarter of 1963 at a reported cost in excess of $10 million. New program will provide packaging, warehousing and loading facilities.

**Webster, N. Y.**—Haloid-Xerox, Inc., Rochester, N. Y., has construction under way on a new plant here where company will manufacture powders used in its document copying machine. Work on the new plant, already under way, is scheduled for completion by June of 1961. Company has recently acquired a 232-acre tract adjacent to company's present 180-acre site on which the plant of 26,000 sq ft will be erected. Cost will be about $1 million.

**Anderson, N. C.**—Clark-Schwebel Fiber Glass Corp., an independent affiliate of M. Lowenstein & Sons, Inc., plans to construct a glass weaving and finishing plant on a 20-acre site located here. New plant will have a floor area of 160,000 sq ft with ample room for more than 400 looms. Work on the structure is already under way and is scheduled for completion the early part of next year. Plant and equipment will cost about $3 million when completed.

**Charlotte, N. C.**—Florida Steel Corp., Tampa, Fla., plans to construct a steel furnace and rolling mill in this area. Plant when completed will be integrated into the operation of Easterly & Mumaw, Inc., a North Carolina steel fabricating and distributing company, whose merger with Florida Steel was approved recently by Florida Steel Corporation's stockholders.

**Raleigh, N. C.**—Corning Glass Works, 1946 Crystal St., Corning, N. Y., plans to build a plant near

(Continued on Page 247)

GENERAL ELECTRIC

# now!

## Tri-Clad '55' motors with THERMO-TECTOR system

# WARRANTED

## against burnout from overheating

For the *first time* General Electric offers you a motor with such *positive* protection it is WARRANTED in writing against overheating burnout!

G.E.'s exclusive new THERMO-TECTOR system gives Tri-Clad '55' motors truly *inherent* over-temperature protection. Unique variable shut-off feature allows motor to deliver *full power potential* under all operating conditions. Fail-safe THERMO-TECTOR system has simple, two-lead hookup.

*Trade-mark of General Electric Co.

**For the first time General Electric offers you a motor with such *positive protection* it is WARRANTED against *overheating burnout***

TURN PAGE FOR FURTHER INFORMATION ➡ ➡ ➡

# NOW - A Motor *Warranted in Writing* Against Overload Burnout!

General Electric Company warrants to the Purchaser that the Tri-Clad '55' motor with Thermo-Tector system delivered hereunder will:

(a) **Not burn out because of overheating resulting from overload, lack of ventilation, single-phasing, stall, high ambient, or voltage unbalance, as long as the Thermo-Tector switches are connected into the control circuit so that power to the motor is removed when an over-temperature condition occurs;**

(b) **Be free from defects in material, workmanship and title; and**

(c) **Be of the kind and quality designated or described in the contract.**

The foregoing warranty is exclusive and in lieu of all other warranties whether written, oral, or implied (including any warranty of merchantability or fitness for purpose). If it appears within one year from the date of shipment by General Electric Company that the equipment delivered hereunder does not meet the warranties specified above and the Purchaser notifies the General Electric Company promptly, the General Electric Company shall thereupon correct any defect, including non-conformance with the specifications, at its option, either by repairing any defective part or parts or by making available at the General Electric Company's plant, a repaired or replacement part.

The liability of the General Electric Company to the Purchaser (except as to title) arising out of the supplying of the said equipment, or its use, whether on warranty, contract or negligence, shall not in any case exceed the cost of correcting defects in the equipment as herein provided and upon the expiration of said one year, all such liability shall terminate. The foregoing shall constitute the sole remedy of the Purchaser and the sole liability of the General Electric Company.

General Electric's *exclusive* THERMO-TECTOR system is available now on *all* Tri-Clad® '55' motors in frames 254U-445U. Contact your General Electric Apparatus Sales Office or Authorized Distributor *today* for details on this NEW FULLY WARRANTED MOTOR PROTECTION SYSTEM. Or, write for Bulletin GEA-7092, Section 866-04, Schenectady 5, N. Y.

SMALL AC MOTOR & GENERATOR DEPARTMENT

GENERAL ELECTRIC

# RESERVED

## FOR THE ENGINEER CONCERNED WITH DESIGNING SAFE, DURABLE, FLEXIBLE LINES

*Send for your copy of*
"FACTS YOU SHOULD KNOW ABOUT SWIVEL JOINTS"

**CHIKSAN**

Written by engineers and well illustrated, this file contains a wealth of useful information on the application of swivel joints in line design. You'll find facts and figures on torque, geometric characteristics, thrust and radial loads. There's information on how to approach design problems and a quick comparison between swivel joints and other flexible devices. And, you'll find a group of actual installation reports with diagramatic drawings showing how the swivel joints were applied in the system. Be sure you have a copy of "Facts you should know about Swivel Joints" in your possession. Write Chiksan for your file today.

**CHIKSAN COMPANY, 300 North Brea Blvd., Brea, California**

**Please send me a copy of "Facts you should know about Swivel Joints."**

NAME_____

COMPANY_____

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CITY_____ STATE_____

#60-53

fmc

A SUBSIDIARY OF FOOD MACHINERY AND CHEMICAL CORPORATION

**CHIKSAN COMPANY—Brea, California** • Chicago 5, Ill. • Newark 2, N. J. • Divisions: Chiksan International, Hamer Valves, Weco • Subsidiary: Chiksan of Canada Ltd.

**For more facts circle 599 on Reply Card**

# ENDS TRAFFIC BOTTLENECKS

**The PREST-O-MATIC® Door takes the STOP out of "Stop and Go" traffic**

Quick-acting PREST-O-MATIC works *for* you, not *against* you. Fully automatic, it prevents slow-downs and bottlenecks—saves you man hours aplenty.

Your fork truck driver simply pulls an overhead cord and goes through the opened door without stopping. The door opens and closes *Prest-O-Matically* in as little as 2 seconds. Compare this with manual doors that require your driver to stop, dismount, open the door, return to the truck, drive through . . . then stop to close the door again! Multiply this waste motion by the number of trips per day . . . per *year*.

Engineered to snug-fit your doorways, PREST-O-MATIC remains tightly closed when not in use. Neoprene Sealing stops drafts, eliminates heat or air-conditioning loss.

**Complete in one easy to install unit.** No extras. Available in Bifold (shown here) and Sliding. You choose the motive power —air or electric. Before you buy any door, get all the facts on PREST-O-MATIC. See our insert in Sweet's Catalog or, better still, write us today.

**CLARK DOOR COMPANY, INC.** *since 1878*

507 Hunterdon St., Newark 8, N. J.

**Prest-O-Matic® Single Sliding Door of hollow metal construction.**

**Air Operated Prest-O-Matic® Double Sliding Door.**

**For more facts circle 600 on Reply Card**

Super COILIFE*, the new epoxy encapsulation, gives your rewound motors extra operating life . . . and is completely compatible with Guardistor* winding protection. It thoroughly protects against acids, alkalis, moisture, oil, dirt and other contaminants. Super Coilife has proved itself in thousands of applications in mines, chemical plants, petroleum refineries, and other industries. With extraordinarily low viscosity, this encapsulation permeates slots and interstices, thoroughly protecting windings inside and out.

*Trade-Marks

# new!! foolproof overtemperature protection for rewound motors

Now, for motors being rewound, Westinghouse offers P.T.C. thermistors—the new Positive Temperature Coefficient semiconductor—to rebuild your conventional motor into a Guardistor motor. Guardistor motors prevent overheating—the major cause of motor failure. This positive protection is available for any make or type of a-c squirrel-cage motor, including multispeed, and for any class of insulation including motors encapsulated with exclusive Super Coilife epoxy.

The heart of the Guardistor motor is the P.T.C. thermistor, one per phase, completely embedded in the motor windings. This inherent protection will provide a warning, will take the motor off the line, or do both. Since the thermistor is temperature sensitive only, it reflects the total winding temperature resulting from all heat sources. It is available for various classes of insulation, at appropriate tripping temperatures, insuring full insulation protection plus full motor capability without nuisance tripping. Westinghouse rewinding with exclusive Guardistor protection is fully guaranteed.

Call your Westinghouse representative for more information on Super Coilife insulation and Guardistor protection on your next motor rewind. You can be sure . . . if it's Westinghouse. J-95218

Westinghouse

# THIS FREE BOOK COULD HELP PREVENT AN ACCIDENT WHERE YOU WORK

You owe it to yourself, and the men you supervise, to learn all about the safety, comfort, and economy of USS Multigrip Floor Plate. This free booklet illustrates the many applications for Multigrip—from plant floors to derrick platforms to ship ladders. What you see in these pages may prevent an accident in *your* future.

Ask for the USS Multigrip booklet at your nearest Steel Service Center or U. S. Steel district sales office. Or write to United States Steel, 525 William Penn Place, Pittsburgh 30, Pennsylvania.

United States Steel Corporation—Pittsburgh
Tennessee Coal & Iron—Fairfield, Alabama
Columbia-Geneva Steel—San Francisco
United States Steel Export Company
**United States Steel**

This mark tells you a product is made of modern, dependable Steel.

*USS is a registered trademark*

**For more facts circle 602 on Reply Card**



**For more facts circle 603 on Reply Card →**

# ONE MAN ONE TRADE ONE TOOL

**...your production line back in operation in**

# 30 SECONDS

**(if it's a Hunt PDQ Air Control Valve)**

☑ **accessibility** ☑ **simplicity** ☑ **speed and capacity** ☑ **price and quality**

No bulletin can do it justice...have the Hunt man call. Write to:

**HUNT** HUNT VALVE COMPANY DIVISION OF IBEC SALEM, OHIO

*Quick-As-Wink* AIR & HYDRAULIC CONTROL VALVES

# CUT INITIAL COST AS MUCH AS 40¢ PER SQ FT

**It's easy with the most powerful fluorescent you can buy!** If you're planning a new building . . . or remodeling an existing one . . . you can shave your initial lighting investment by as much as 40¢ a square foot.

**How? Specify G-E Power Groove* Lamps.** They give you more light than any other lamp. You use fewer lamps, fewer fixtures, fewer everything else it takes to light your building properly. And your savings keep mounting. With fewer lamps, fixtures and ballasts, your maintenance bills will be lower, too.

**The secret's in the grooves.** They're what bend the arc stream (it's straight in other fluorescents) . . . lengthen it . . . make the lamp put out more light. Only G-E Power Groove Lamps have 'em. Only General Electric gives you this years-ahead light source—another example of a difference that makes a difference in value to you. Call your G-E Lamp distributor next time *you* need lamps. General Electric Company, Large Lamp Dept. C-031, Nela Park, Cleveland 12, O.

*General Electric's trademark for configurated fluorescent lamps

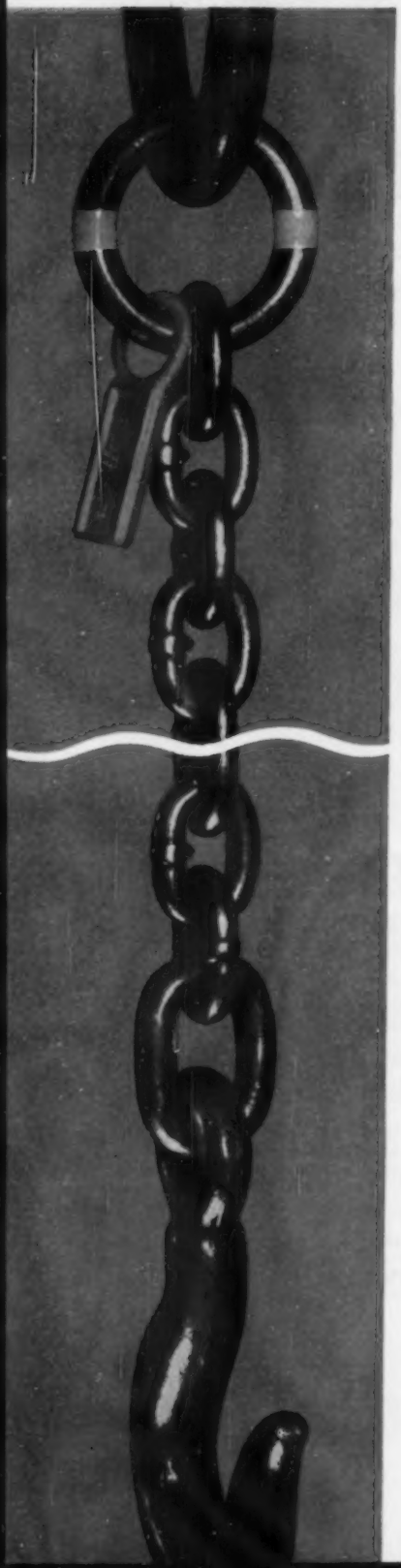
*Progress Is Our Most Important Product*

**GENERAL ELECTRIC**

For more facts circle 604 on Reply Card

## *New and Revolutionary...*

# SLING CHAINS THAT TALK



**The WARNING RING on Campbell SENTRY SLINGS* tells you immediately when the sling has been overloaded . . . it elongates visibly . . . and before the chain itself is damaged.**

***Your eye can see the difference!***

**Ring remains round**
**Sling used properly**

**Ring distorted**
**Sling overloaded**

New, revolutionary . . . Campbell **SENTRY SLINGS**—fully tested for over a year by foundries, steel fabricators and heavy equipment manufacturers, offer many important advantages. The **WARNING RING** is stronger than the chain itself. Yet it changes shape as the sling is overloaded . . . *before permanent damage occurs.* Repair is quick and easy, with a new **WARNING RING** replaced at the factory. Re-tested and re-certified Sentry Slings are again ready for regular service.

**Here's How You Benefit From New SENTRY SLINGS:**

- Safety programs are easier to maintain—with the **WARNING RING**'s built-in safety that protects men and material!
- Lower repair costs give larger savings than ever—normally only the **WARNING RING** will need repair!
- Immediate visual evidence of overload means easier inspection—even while sling is in use!

**SENTRY SLINGS,** available in all types, are made from Cam-Alloy steel chain only and are available at no extra cost! All slings carry the Campbell Guarantee and Certificate of Test.

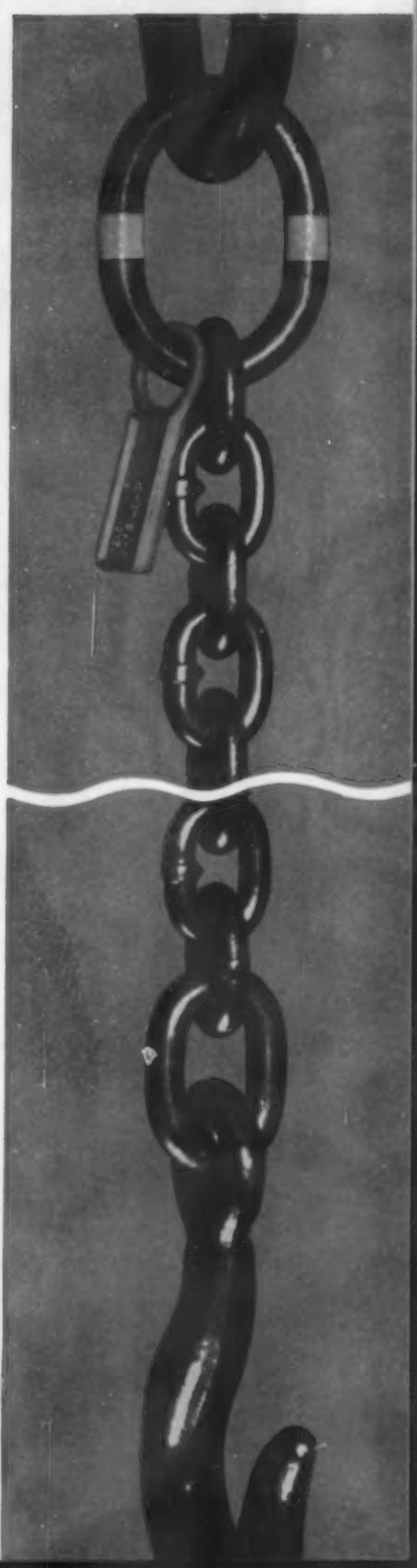
CAMPBELL with the WARNING RING SENTRY SLING

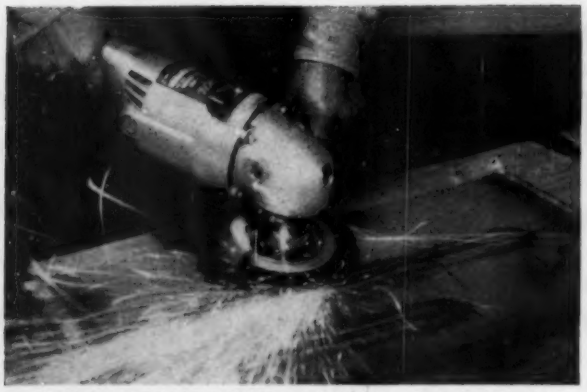
**CAMPBELL CHAIN *Company***

**FACTORIES: York, Pa.; West Burlington, Iowa; Union City, Calif. WAREHOUSES: East Cambridge, Mass.; Atlanta, Ga.; Dallas, Texas; Chicago, Ill.; Portland, Ore.; Seattle, Wash.; Los Angeles, Calif.**

*Patent Applied For

**For more facts circle 605 on Reply Card**





**LIGHT DUTY GRINDING:** A SKIL Raised Hub Wheel Kit and safety guard are all you need to quickly convert the 7" or 9" Disc Sander into a versatile grinder.

**HEAVY DUTY GRINDING:** Convenient spindle lock lets you quickly mount any of 37 SKIL silicon carbide or aluminum oxide abrasive wheels to handle rugged, heavy duty grinding jobs.

**SANDING AND FINISH BLENDING:** Smooth, steady, vibration free power lets you do faster, better sanding and finish blending in less time.

**CLEAN-UP JOBS:** Clean castings, structural steel, tanks, vats, sheet metals, concrete . . . remove rust, scale and paint . . . do dozens of production and maintenance jobs with wire wheel-equipped SKIL Models 852 or 853.

# Skil grinders do all 4 jobs with power to spare

## Compare Skil Models 852-53 with other leading grinders

Check the chart at right. It's proof that powerhouse Skil sander-grinders give you more work-saving power than the other four leading makes.

And "most powerful" is just one of the advantages. Your Skil distributor can show you that Skil sander-grinders have what it takes in the easy handling and maintenance-free departments, too. He's listed under "Tools, Electric" in the Yellow Pages.

Or for full information write to Skil Corporation, 5033 Elston Avenue, Chicago 30, Illinois, Dept. 120K; in Canada: 3601 Dundas Street West, Toronto 9, Ontario.

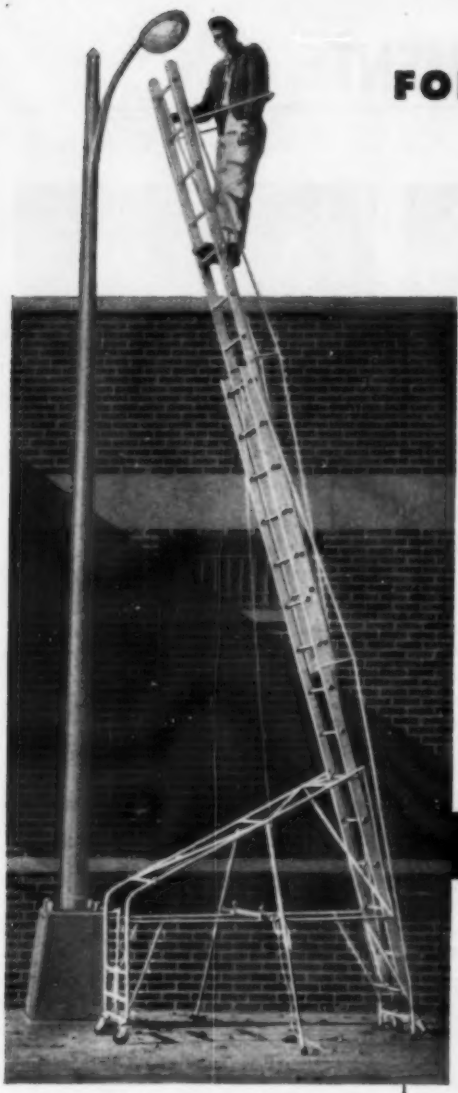
| 9" Models | SKIL #852 | Brand A | Brand B | Brand C | Brand D |
|---|---|---|---|---|---|
| Amp. Rating | 12 | 10 | 8 | 11.5 | 10 |
| Max. H.P. | 2.48 | 2.2 | 1.3 | 1.70 | 1.92 |
| Net Wt. | 12¼ | 12¾ | 14 | 12¾ | 15¾ |
| **7" Models** | **SKIL #853** | **Brand A** | **Brand B** | **Brand C** | **Brand D** |
| Amp. Rating | 12 | 10 | 8 | 8.5 | 9 |
| Max. H.P. | 2.48 | 2.2 | 1.4 | 1.69 | 1.03 |
| Net Wt. | 12¼ | 12¾ | 14 | 12¾ | 13¾ |

SKIL . . . and SKILSAW POWER TOOLS

For more facts circle 606 on Reply Card

*Patent Applied For

For more facts circle 605 on Reply Card

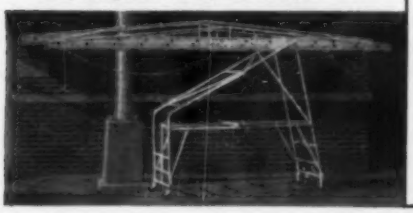


# FOR MORE USES... MORE SAFETY— BUY Bally-Hi

Open construction design allows the "Bally-Hi"—a two-stage ladder mounted on a wheeled frame—to move between and over obstacles such as machines, furniture or rows of seats—where ordinary ladders can't go. Collapsible outriggers add extra stability . . . prevent tipping over. It reaches heights to 25 ft. . . . anchors to floor firmly. And it's so compact, it goes through average size doorways.

The "Bally-Hi" ladder is loaded with extra safety and comfort features. Ladder guard rails, including a collapsible pulpit type at the top, help protect the user. A flat step instead of an uncomfortable rung makes working at heights for long periods of time much easier. Locking devices hold the ladder even on sloping or uneven ground. "Bally-Hi" may be truck-mounted.

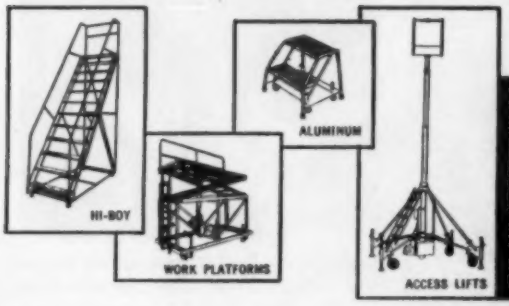
When the ladder is collapsed, the overall height of the entire unit is only 77", permitting the "Bally-Hi" to go easily through even ordinary size doorways.



## BALLYMORE "Safety-Step" LADDERS SERVE INDUSTRY—

WITH OR WITHOUT HANDRAILS

*Call your* LOCAL DISTRIBUTOR




Ballymore Safety Ladders

*For complete details write to*
BALLYMORE COMPANY • WEST CHESTER 29, PA.

# BALLYMORE

EQUIPMENT FOR WORKING *Safely* ABOVE FLOOR LEVEL

For more facts circle 607 on Reply Card

# PLANT ENGINEERING EQUIPMENT®

*Edited by M. E. Heniken*

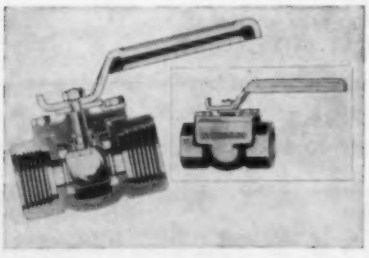
## TELESCRIBER plugs in, writes directly on paper

Model D Telescriber is transistorized and writes directly on paper. Either plain or printed forms (7-by-5 in. or 3½-by-5 in.) can be used on the sprocket feed. Its compact size and modern design make it portable with a direct plug-in to any 110-v outlet. New features announced for Model D include a built-in lock-out to prevent two persons—at either end of the line —using the machine at the same time; a simple on-off switch; novel form-feeding method. Model D makes carbon copies; it can be counter-sunk in desk of table; it has a visual paper supply; it can be engineered to system requirements. The operator writes with a ball-point pen stylus and any color ink may be used. TELautograph Corp.

**For details, circle 1 on Post Card**

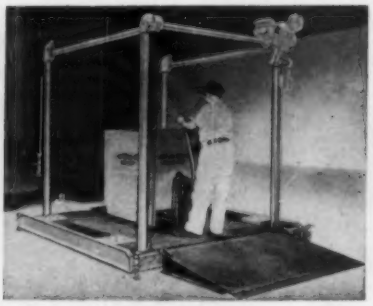
## BALL VALVE has top entry for easy maintenance

Fig. 700 Ball Valves are being introduced in bronze body, screw ends, pipe sizes ¼ to 2 in., with Teflon or Buna-N seats and seals. Top entry design makes possible easy in-line



maintenance, exposing ball for removal with tool on valve's specially built handle. Ball is flat on top and bottom, so it can be removed from body for access to seats without breaking pipe. Lunkenhaimer Co.

**For details, circle 2 on Post Card**



## ELECTRIC-POWERED LIFT doesn't need foundation

The Cabl-Lift for handling, lifting, loading or leveling does not require any foundation, company says, and plates are provided on corner posts for bolting to floor if permanent location is desired. Portable units are provided with floor frame and swivel casters. Capacities range to 6000 lb with platform size of 6 ft by 8 ft 6⅞ in. Available in three models, lift is powered by 1-hp high-torque motor, can be plugged in to an outlet. The Wayne Pump Co., Div., Symington Wayne Corp.

**For details, circle 3 on Post Card**

## ELECTRIC MATS clear snow, ice from concrete steps

When snowfall or freezing begins, the electric concrete step heater mat will prevent accumulation and keep steps clear and safe without shoveling, salt or cinders, company states. The heaters are Thermwire heating cable interwoven with light weight galvanized mesh with ratings of 42 per square foot. They are offered in two- and three-step units, heating a section 8-by-36 in on each step. Any combination may be used to match the number of steps requiring protection. Each heater unit contains a 10-ft lead wire, a 10-ft ground wire and cable sections sheathed in polyvinyl with nylon coating. The units are positioned on top of freshly poured layer of concrete, then covered with 1-to 1½-in top layer. An inside wall switch controls heaters. Edwin L. Wiegand Co.

**For details, circle 4 on Post Card**

**Reader Service Post Cards for requesting more details on products described are provided on pages 255-256.**

## SLING CHAINS show when they're overloaded

Sentry Slings incorporate a warning ring to provide visual evidence of overload. The warning ring elongates when the sling is overloaded, manufacturer states, and though stronger than the chain itself, this ring gives immediate warning by changing shape —before permanent damage occurs. Warning rings can be replaced at the factory, it is noted, and in most cases only the ring need be replaced, minimizing repair costs. Sentry Slings come in many types, are made from Cam-Alloy steel chain. Chain at left of photo shows ring distorted from overload. In chain at right, the ring remains round due to proper loading. The Campbell Chain. Co.

**For details, circle 5 on Post Card**

## SELECTOR/COUNTER for conveyor belt application

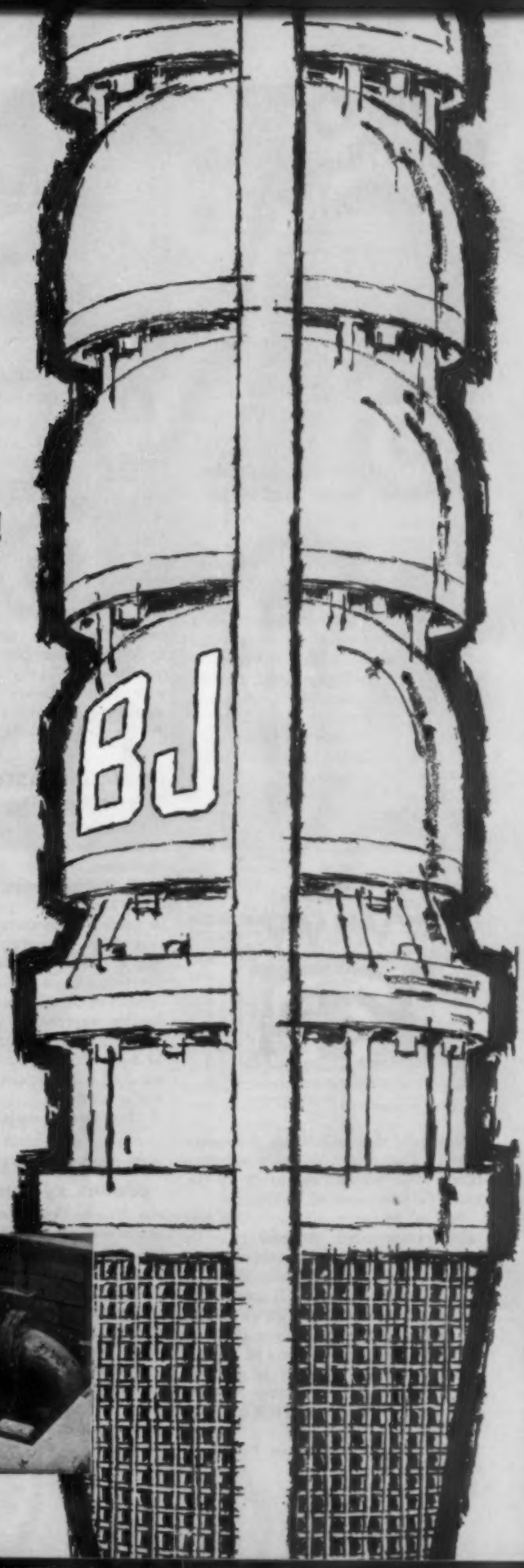
Atronic Selector/Counter, Model 410-C, is announced as an automatic electronic instrument for conveyor line use, which optically selects and counts up to 31 types of items for discharge or routing. It is designed to recognize (photoelectrically) 31 different codes printed on containers, and to actuate the self-contained counting unit and conveyor switch control. With it, up

to 31 types of containers can be sorted and counted from one conveyor line. In operation, a light source in the



**For more facts circle 608 on Reply Card**——►

# Quality *costs less* in the long run!




## BJ Submersible Pumps

Nowhere is quality more important than in a submersible pump installation where both pump and motor operate down-hole. And that's where BJ quality pays off!

Sealed for life, no adjustments or routine maintenance is required...no noise, no pump house needed, and there is no danger of vandalism or contamination of the well.

As a pioneer in submersible pumps since 1928, BJ manufactures all three basic components—pump, motor and seal—and offers complete unit responsibility with *the* quality submersible pump. Available in capacities from 20 to 20,000 GPM, heads to 1,800 feet and motors to 450 HP.

**BYRON JACKSON PUMPS, INC.**
Subsidiary of Borg-Warner Corporation
*P.O. Box 70, Lawrenceburg, Indiana*
*P.O. Box 2017 A, Terminal Annex, Los Angeles 54, California*
Offices in Principal Cities

**SAVES PLANT SPACE** —These 5 stage BJ Submersibles in a covered pump pit use no valuable floor space, yet deliver 1100 GPM against a 203 foot head.

**For more facts circle 608 on Reply Card**

# PLANT ENGINEERING EQUIPMENT

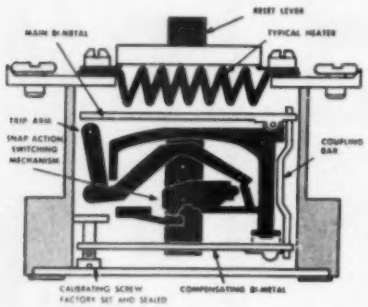
(Begins on page 200)

unit illuminates the printed code on the side of a moving carton. The code is "read" by semiconductor photocells, which energize the appropriate counting and selection circuits by closing corresponding relays. Atronic Products Inc.

▲ For details, circle 6 on Post Card

## OVERLOAD RELAY compensates for heat and cold

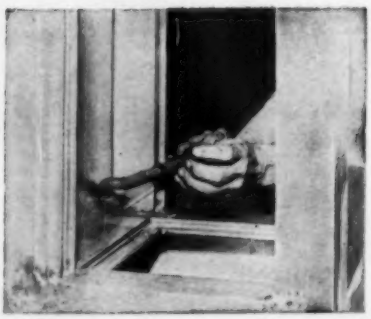
This compact overload relay is designed to compensate for both heat and cold, operating on the same time curve for all temperatures from −20 to 165 F. This performance is due to a "balancing bi-metal" feature located in a separate compartment and not affected by heat applied to the working bi-metal. The working bi-metal and the compensating bi-metal, identical in size and construction, are joined by a coupling bar. As ambient temperature rises above 72 F, the compensating bi-metal operates through the coupling bar to move the working bi-metal in order to maintain its distance from the trip arm. Therefore, tripping time




remains the same regardless of temperature. The relay has a calibrating screw to permit factory setting for the exact current required.

According to manufacturer, this ambient compensated overload relay is smaller than other comparable units, its base size being that of company's standard overload relays. It uses standard heaters and works with quick-trip or regular type. Available with all of company's magnetic starters in NEMA Sizes 0 through 5, relay is supplied in ratings from 25 to 300 amp, continuous current. The Arrow-Hart & Hegeman Electric Co.

▲ For details, circle 7 on Post Card



## TORCH for tungsten inert gas, arc welding

This controlled angle torch features a flexible body that can be hand-adjusted to any angle as well as extended to reach into difficult recesses—enabling use of one torch for many torches of varying head, angles, styles and sizes. According to manufacturer, this torch promotes better and faster welding as well as less operator fatigue. It is also said to require minimum maintenance. A water-cooled model, now available, is rated at 180 amp ac-dc, continuous duty; 300 amp, intermittent duty. Lower and higher rated water-cooled torches and an air-cooled model will be produced. Falstrom Co.

▲ For details, circle 8 on Post Card

## FOAMED PLASTIC for use as load bearing insulation

Rigid Armaflex is a rigid plastic material designed for use as load bearing insulation at pipe hanger locations, deeply buried underground lines, and other areas where pipe covering may be subject to compression set deformation. With properties similar to Armaflex 22, a flexible foamed plastic pipe covering, Rigid Armaflex was developed to be used in conjunction with the flexible material. It comes in ½- and ¾-in. thicknesses for sizes ⅜ in. ID to 3 in. IPS, and is furnished in prematched half sections 3-ft long. Armstrong Cork Co.

▲ For details, circle 9 on Post Card

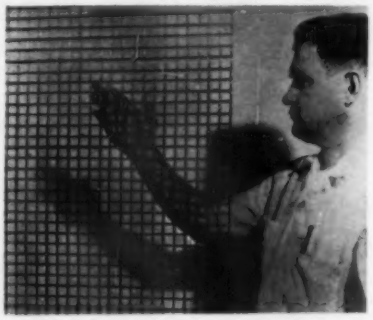
## AIR WASH TREATMENT improves system efficiency

Air Wash Treatment 1 is a surface active compound for improving operating efficiency of air wash systems in textile mills and tobacco plants. It is formulated to remove sticky deposits in operating air wash systems and to prevent formation of new deposits in clean systems. Soluble in water, the compound is compatible with standard corrosion and scale inhibitors and biocides normally present in chilled recirculating cooling water. Manufacturer says it does not create foam or froth, is almost water white and has a mild, spirit-like odor. It is ready for use and is fed to the chilled water by slowly pouring the required amount to a point of rapid circulation. Dearborn Chemical Co.

▲ For details, circle 10 on Post Card

## INDUSTRIAL FENCING made of glass rovings and resins

Firm-A-Line Fencing is described as a corrosion resistant, non-conductive, fire retardant fencing composed of continuous strands of glass rovings and polyester resins. According to manufacturer, this lightweight fencing is both long lasting and strong; it is rat-proof and has no moisture pick-up, and it does not require paint. Standard thicknesses ⅜ in. on 1-in. center. Standard size is 30-by-80 in., weight is



⅛ lb per square foot, and fiber glass tensile strength is 125,000 psi. Pigmented resins make possible many color variations and can provide safety colors and color coding. The fencing can be cut with tinsnips, hacksaw and hand-powered tools. In addition to use as fencing or protective screening in corrosive atmospheres, Firm-A-Line Fencing is also suggested for machine and acid bath guards and fencing around electrical installations. Crompton & Knowles Corp.

▲ For details, circle 11 on Post Card

## CENTRIFUGAL PUMPS have space-saving features

Reduced space requirements of OJV and OMV Vertical Split Case Pumps suggest their use where extreme compactness is of prime importance. Case is split parallel with impeller shaft with suction and discharge flanges integral in vertical base section. Rotating unit is removed easily, company says, for inspection or maintenance without disturbing suction or discharge piping connections. Pump is designed for handling high capacities at medium to high speeds and continuous operations in such applications as municipal water service, industrial water service, booster service, cooling towers,

WHEN THE PROBLEM CALLS FOR PAINT THE BEST ANSWER

IS INVARIABLY **Barreled Sunlight** ENGINEERED *Paints*

**Weather** — wet, dry, hot, cold, mild or rugged — sooner or later gets under the skin of even the best buildings. In fact, *no* paint ever completely resists its ravages.

**However,** over the years in all types of climate, it has been clearly shown that Barreled Sunlight Engineered Paints do a *better* job of resisting the wear and tear of weather than any other paint you can buy. Actual "on-the-wall" tests also prove their measurably greater hiding power which means less paint per job . . . their labor-saving ease of application which cuts costly man-hours to a money-saving minimum.

**Your** paint maintenance problem may be weather or it may be something else again. In any case, it will pay you to learn more about Barreled Sunlight Engineered Paints.

**BARRELED SUNLIGHT PAINT COMPANY**
**125-K Georgia Avenue, Providence 5, Rhode Island**

I want more information on Barreled Sunlight Paints.

☐ Please send me your "Quick Reference Painting Guide" plus your booklet, HOW TO REDUCE PAINTING COSTS.

☐ Please have your representative call me to arrange a free Barreled Sunlight "On-the-Wall" Test.

*Name*.....

*Title*.....

*Company*.....

*City*.....*Zone*.....*State*.....

**For more facts circle 609 on Reply Card**

# PLANT ENGINEERING EQUIPMENT

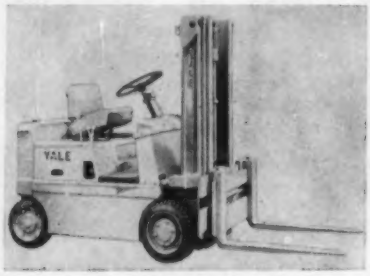
(Begins on page 200)

fuel service, circulating and boiler feed. Capacities range to 6000 gpm and heads to 380 ft. Aurora Pump Div., The New York Air Brake Co.

**For details, circle 12 on Post Card**

## LIFT TRUCKS provide greater work capacity

Improvements in power transmission, mast construction, compactness, operating speeds, stability, operator comfort, and ease of maintenance are announced for the G-54 line of gasoline and LP-gas powered industrial lift trucks. Short turning radii of 72 in. for 3000 lb capacity model, plus lift




speed of 75 fpm fully loaded, provides faster cyclic operations, company says. Compact dimensions permit narrow aisle operations, increased maneuverability in cramped space. Automatic torque transmission is standard. Cushion tire model uses single range constant mesh type while pneumatic tire model has two-speed range transmission. Capacities include 4000 and 5000 lb models as well as 3000 lb. The Yale & Towne Mfg. Co.

**For details, circle 13 on Post Card**

## CONTROL PANEL regulates up to five compressors

Introduced to serve as a single control point for as many as five electric motor driven compressors, this automatic control panel is designed to keep in operation only those machines required for the immediate demands of process air or gas; to permit manual or automatic control of any or all compressors start up and shut down in accordance with a sequence set by manually operated base unit selector. No two machines can start at the same time, company says, and each preceding machine must be running before the next unit can start. By alternate selection of base unit, even wear is distributed over all compressors in system, and what would normally be No. 1 compressor is relieved of continuous duty. Clark Bros. Co.

**For details, circle 14 on Post Card**

## STEAM CONVERTER for heating radiation water

Among advantages claimed for the SC Converter are simplified piping design and reduced design work. Primarily for heating radiation water with steam, the SC is reported highly efficient for providing heating water for office space in industrial buildings. When applied to high buildings, it is said to keep static heads at reasonable levels as well as simplifying piping. Dunham-Bush, Inc.

**For details, circle 15 on Post Card**

## CHEMICAL FEEDER handles powders, granules, lumps

Type G Feeder is designed to handle all dry chemicals normally used in water and waste treatment, whether chemicals are in powder, granule or lump form up to ¼ in. diam. Finely balanced weighing mechanism gives an accuracy of ±1 per cent, company says, of the set rate over an operating range of 20:1. Feeder is housed in dust-tight enclosure, with electrical and operating controls an integral part of unit, but separated from feeding mechanism by dust-tight partition. Agitators within hopper are made to prevent arching or "hold-up" of chemicals. Infilco Inc.

**For details, circle 16 on Post Card**

## PROTECTIVE FILM for metals in process, storage

CRC Soft-Seal is announced as a low cost protective coating to prevent corrosion of metals in production processes, storage and shipment. It has an affinity for metal, company says, penetrating grain boundaries, cracks and pores to form a continuous protective film from 1 to 8 microns thick. Applied by spray or immersion, it is said to be equally effective on iron, steel, aluminum, magnesium and plated finishes, and other surfaces. Conditions of exposure determine length of time it remains effective, from less than a year to more than 5 yr. It may be reapplied at intervals to maintain protection. It comes in 16 oz aerosol cans, and 1, 5 and 55 gal containers. Corrosion Reaction Consultants.

**For details, circle 17 on Post Card**

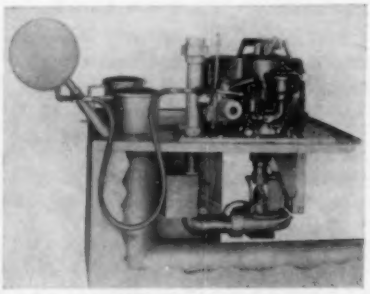
## INFRA-RED CONVEYOR for setting and drying

This infra-red unit features an aluminum alloy conveyor with oven temperatures to 500 F for heat conditioning, setting and drying. It is described as an easily assembled pre-fab with acid-resistant, corrosion-resistant and rustproof qualities, and controlled reflective heat. Hot water or steam may be used to clean the conveyor. Other features noted are: vibrationless movement, variable speed, reversible controls, cleats for incline operation, and speeds to 100 fpm. Standard 5-ft sections are available. Engineering data and specifications are in Bulletin 300. Mercury Industries, Inc.

**For details, circle 18 on Post Card**

## PUMP sends up roofing materials at mopping heat

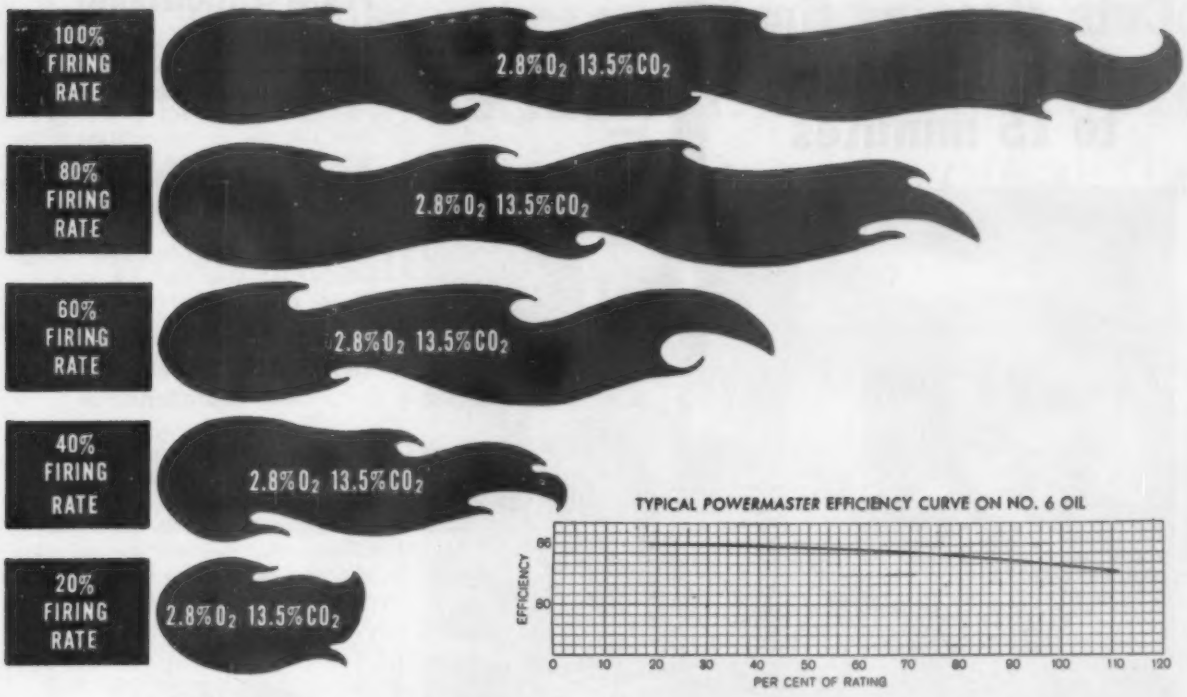
Claimed virtually maintenance free, this kettle-to-roof pump is designed to deliver hot materials at mopping temperature. It is powered by a four-cycle, air-cooled gasoline engine. A carburetor conversion kit for L-P gas can be had. It is noted that open-flame



preheating is not required because this pump is preheated and primed by the "hot" already in the kettle. The pump is ready to work when the hot is ready to pour. Constant recirculation of the hot while the engine is idling is said to eliminate hot spots and make possible a cleaner kettle because impurities remain in suspension.

Material goes to the roof through a single line system. Supply is controlled

FROM THE WORLD LEADER IN PACKAGED AUTOMATIC BOILERS AND BURNERS




# Only *Powermaster*® gives you this type efficiency

**Constant fuel-air ratio assures maximum efficiency at any load . . . cuts operating costs . . . returns investment faster**

Whether you operate a *Powermaster* boiler from a low of 20% to a high of 100% of capacity, you get the same high constant efficiency. With O&S exclusive 5 to 1 turndown, fuel-air ratio is maintained at all loads with the same low percentage of excess air (2.8% $O_2$) and high percentage of $CO_2$ (13.5%).

This constant efficiency is important to you for three reasons: 1. Lower operating costs; 2. faster return on your investment; 3. more uniform heating, more uniform process and improved product quality.

Whether your requirements are for comfort heating, process or power, you'll pay for your boiler investment faster with an O&S *Powermaster*. For information on all *Powermaster* benefits, call your nearest O&S representative or write for Bulletin 1260.

75th Anniversary

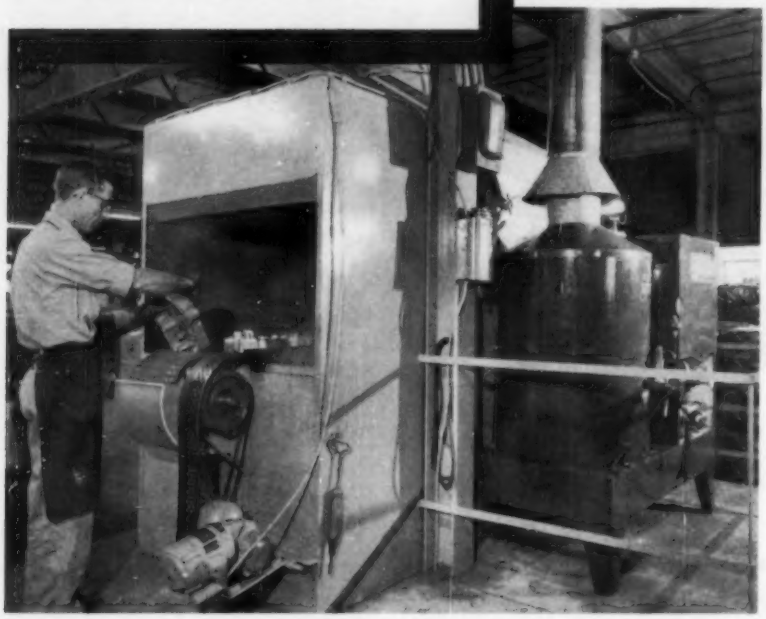
**ORR & SEMBOWER, INC.**
940 Morgantown Road
Reading, Pa. • Since 1885

*Powermaster*®
PACKAGED AUTOMATIC BOILERS

For more facts circle 610 on Reply Card

# Cuts cleaning time from 1¾ hours to 15 minutes

Gravely Tractors, Inc., Dunbar, W. Va., mounts one cleaning gun of Malsbary 230 steam cleaner 12" above stainless steel conveyor belt, the other 12" beneath belt, and runs castings between them.



Degreasing and air blasting to get rid of oil, grease and machine grindings on crank cases—handled 60 at a time—just took too long. Then Gravely Tractors installed a 2-gun Malsbary 230 steam cleaner, which degreases and thoroughly cleans castings in 1/7th the time formerly required.

## PLACE CLEANER WHERE YOU WISH

...adjacent to work, or 100 to 200 ft. away. This option is yours because the Model 230 is equipped with nozzle control with which operator starts and stops solution flow by squeezing and releasing his grip on hand gun. The Gravely installation is in the assembly area, where solution flow is controlled automatically. Cleaner occupies only 63" x 36" floor space.

Model 230 delivers 180 gph at 60 to 100 psig without smoke, soot or fumes. Thermostat holds solution temperature to within 50° F. of setting. Complete range of Malsbary models for phosphating, production cleaning and maintenance.

**MALSBARY**

Malsbary Manufacturing Co. • 845 92nd Ave., Oakland 3, Cal.

Malsbary Manufacturing Co. / 845-92nd Ave., Oakland 3, Calif. 152

I would like ☐ Industrial Steam Cleaning portfolio; ☐ Phosphating Manual; ☐ Personal consultation on cleaning problems.

Name_____ Position_____

Company_____

Address_____

For more facts circle 611 on Reply Card


# PLANT ENGINEERING EQUIPMENT

(Begins on page 200)

from the roof by manipulation of the pump lanyard. Up to 30 gpm can be delivered to a 100-ft head. The pump is self-lubricating, using the hot bitumen under pressure to provide a frictionless surface on which the bearings ride. Hauck Mfg. Co.

▲ For details, circle 19 on Post Card

## UNIT AIR FILTER requires less maintenance

AAF Foamat Filter employs a single sheet of synthetic plastic material. Sponge-like in appearance, Foamat breaks an air stream into little jets as it passes through the filter, is is explained; dust and dirt cannot follow and are trapped by the cells. Designed as a permanent filter, Foamat will not pack, settle, separate or develop "thin" spots, says manufacturer, and it can

be washed with a standard spray-head hose nozzle without removal from the filter bank. Where stubborn process dusts are encountered, filters may be removed, soaked in mild detergent, rinsed and reset in place.

This filter media is pleated into a holding frame and is interchangeable with other pleated-media filters. It is chemically treated for flame resistance. Three models permit capacities to 1800 cfm per cell. Foamat is designed to handle velocities to 450 fpm. Aluminum cells are standard. Bulletin 208 gives full information. American Air Filter Co., Inc.

▲ For details, circle 20 on Post Card

## CENTRIFUGAL PUMPS for sewage, waste disposal

These vertical centrifugal pumps for disposal of raw sewage, industrial waste, solids in liquid suspension, etc., come in capacities from 50 to 600 gpm. Features announced include screenless

# ".....we knew you would want all these switchgear advances. And we were determined to bring them to you at the lowest possible cost."

*—Frederick G. Schmidt, Manager Switchgear Division, I-T-E Circuit Breaker Company*

Frankly, we had a big decision to make when we were designing this new HK metal-clad switchgear. Should we go ahead with a complete redesign or should we simply add the new features we knew you wanted to our previous models? The latter would have been easier, and it still would have put us well ahead of the field. But we decided it would be more honest to give you the benefit of as much progress as possible as soon as we could. And we were confident that in this case we could give you all these advances at a price no higher than you would pay for equipment with none of them.

First we wanted to give you stored energy closing. No circuit breaker in this class can really be called modern today without this feature. It insures that you can have fast, uniform closing every time. In fact, I-T-E makes it possible for you to close the breaker even during emergencies when you have lost control power. Fast closing reduces breaker upkeep—prolongs contact life. And I-T-E's motor-driven spring charging mechanism needs only about one-tenth the power of other devices. So you can enjoy the economy of a smaller battery or control transformer.

To give you still greater safety too—again with no increase in cost—we designed this switchgear so you never need open the doors to move the breakers. You can go all the way from connected through test position, to disconnected, and back again with the door closed.

Where else can you find safety like this in metal-clad switchgear? Even an inexperienced man can operate it in complete safety. Because we were designing this equipment completely new from the ground up, we had the opportunity to make the components more accessible and provided more elbow room inside the compartments. The bus is higher, for example, making installation and inspection easier. The control cables are brought in at the front for convenience and safe access away from the high-voltage bus. The current transformers are located behind the shutter in the circuit breaker compartment and may be easily changed without disassembling the bus or cable connections.

We were meticulous from the beginning about taking full advantage of the many new materials now available for switchgear use. And through careful selection of materials, skillful arrangement of components, and shrewd economy of space, we were able to give you all these advances in a substantially smaller package as standard equipment. The gear fits under lower overheads and in narrower aisles. Yet it gives you actually more usable space inside than you had before. Circuit breakers are lower, lighter and easier to handle. Instruments are at eye level. We believe you will agree there is no finer switchgear available today anywhere.

A complete description of this equipment is contained in our new illustrated Bulletin 2801-2A. Send for your copy. And ask to see our new sound strip film. We'll bring it to your office. You can see it in 18 minutes. I-T-E Circuit Breaker Company, Dept. SW, 1900 Hamilton St., Philadelphia 30, Pa.

**For more facts circle 612 on Reply Card**

# PLANT ENGINEERING EQUIPMENT

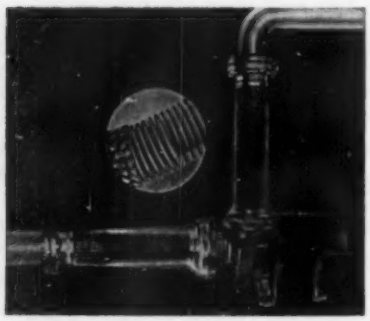
(Begins on page 200)

operation with non-clogging impellers that can handle large solids and stringy material; heavy duty sealed ball thrust bearings independent of motor bearings; adjustment for raising or lowering shaft; and tongue and groove shaft column connections. Models have discharge heads to 75 ft and are available in a suspended pump type for pit depths to 17 ft, and submersible pumps for excessively deep settings and noiseless operation. Bronze and stainless steel construction can be furnished for opertion in corrosive liquids. Pumps are offered in single or duplex arrangements—single for secondary service, and duplex if continuous service is critical. Walter H. Eagan Co., Inc.

▲ For details, circle 21 on Post Card

## FLEXIBLE CONNECTORS for pumps and pipelines

Troublesome effects of pipeline vibration, misalignment, or thermal expansion in pump installations are said to be absorbed or reduced by H. A. P. Flexible Pump Connectors. Consisting of a short section of corrugated flexible metal tubing, protected against pressure elongation by wire braid, these pump connectors have threaded or flanged end connections to fit standard piping sizes; are available from ¼ through 16 in. in stainless steel, ¼ through 8 in. in bronze and hot-



dip galvanized steel, and ¼ through 4 in. in Monel.

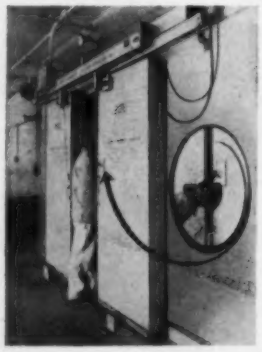
The units are designed to handle pressures to 1500 psig, depending on alloy, braid construction and size. Manufacturer points out that their helical, rather than annular, corrugations offer less resistance to flow, while distributing stresses along entire hose length to minimize localized failures. Safety factor of each hose unit is given as four times the rated working pressure. Allied Metal Hose Co.

▲ For details, circle 22 on Post Card

More information on any of this equipment can be yours without cost or obligation. Just circle the item numbers on the Reader Service Cards provided on pages 255-256.

## PEDESTRIAN SWITCH opens cold storage doors

For incorporation in new or existing Prest-O-Matic Cold Storage Doors the POM (partial opening man) Switch, designed to open doors only 32 in. wide to accommodate foot traffic, saving time and refrigeration. The door closes



automatically behind the person. Since the typical automatic door is controlled by pull cord switches which open the door to its full width, this switch was developed to eliminate unnecessary losses of cold air. Doors can be equipped with two door-mounted pushbuttons, one on either side of the panel. You press either switch to open door. Clark Door Co., Inc.

▲ For details, circle 23 on Post Card

## PIPE PLUGS have hollow design, improved sealing

Hollow design inside these low-cost, lightweight plugs enables them to seal tightly without sealing compound, company says. Made of Du Pont Delrin, plugs are suggested for use with all types of organic fluids in such products as compressors, pumps, gas and water meters, fuel pumps, air conditioners, hydraulic and pneumatic cylinders, vibration devices, etc. They come in ⅛- to ½-in. sizes in square

# THE CORRECT ANSWER IS IMPORTANT TO AIR COMPRESSOR OPERATORS

The correct answer is #4, because this twisted mass is lethal industrial shrapnel . . . once part of a stainless steel pipe in a 6,000 psi air compressor line . . . where heat caused oil-saturated air to explode.

*Fortified* Houghto-Safe Fire-Resistant Fluids would have prevented the explosion. And because Houghto-Safe is *fortified*, it would also have provided all the lubricity needed to assure long compressor life.

In addition to fire and explosion safety, *Fortified* Houghto-Safe Fluids give over-all wear protection comparable to that of the best petroleum oils. And with it you get completely unbiased service from the only manufacturer who offers all types of fire and explosion-resistant fluids (Water-Glycol, Phosphate-Ester, Emulsion Type) *and compatible packings* for any industrial pneumatic or hydraulic systems.

**FREE! Valuable new technical data on safe lubrication of air compressors. Write E. F. Houghton & Co., 303 W. Lehigh Ave., Phila. 33, Pa.**

Industry's Partner in Production

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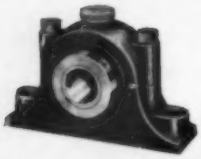
Philadelphia, Pa. • Chicago, Ill. • Carrollton, Ga. Detroit, Mich. • South San Francisco, Calif. • Toronto, Canada

**For more facts circle 613 on Reply Card**

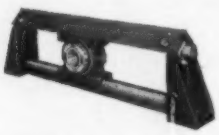


**DODGE PILLOW BLOCKS with TIMKEN BEARINGS**

*America's Quality Pillow Blocks!*

**TAPER-LOCK STEEL CONVEYOR PULLEYS**

*Maximum strength with minimum weight!*



**DODGE TAKE-UPS**

*Complete range of stock models, sizes.*

●

**Write for Bulletins!**

- Rolling Bearings — ratings, data.
- Conveyor Pulleys — technical data.
- Take-Ups — Roller, Ball, Babbitted.

**DODGE MANUFACTURING CORPORATION**
**2700 Union Street • Mishawaka, Indiana**

**DODGE**
of Mishawaka, Ind.

**For more facts circle 614 on Reply Card**


# PLANT ENGINEERING EQUIPMENT

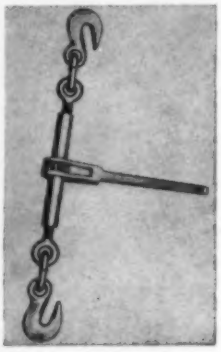
(Begins on page 200)

heads, and ⅛- and ¼-in. sizes in hex heads. Delrin, a stable form of polymerized formaldehyde, offers all thermoplastic properties of strength and rigidity, high dimensional stability, tensile and flexural strength, under broad range of service conditions, company notes. Russell, Burdsall & Ward Bolt and Nut Co.

**▲ For details, circle 24 on Post Card**

## LOAD BINDER is improved ratchet type

Designed to "get the last half link of chain" in take-up, the Lebus Load Binder features rigid one-piece construction, a rustproofed ratchet spring, and extra heavy barrel. It has forged alloy hooks and one-piece handle, and



is said to require no cheater to bind a load tight. It is described as light in weight, yet strong, and as having square threads which allow easier tightening and self cleaning. Three available models fit chain sizes of ⅜, ½ and ⅝ in., offer breaking strengths of 16,200 to 37,000 lb. All models have 8-in. take-up. Crosby-Laughlin Div., American Hoist & Derrick Co.

**▲ For details, circle 25 on Post Card**

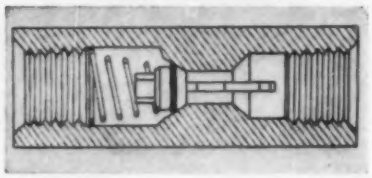
## SOLUTION FEEDER for small water system uses

No. 88 is a solution feeder for feeding hypochlorite to well water systems. It also feeds complex phosphate to correct iron water troubles, and feeds other chemicals including Calgon acid neutralizer. The small heavy duty 115-v motor introduces treatment into the line under suction or up to 100 psi pressure. Manufacturer says the unit is easy to install and maintain and will operate outdoors in rain or snow. Calgon Div., Hagan Chemicals & Controls, Inc.

**▲ For details, circle 26 on Post Card**

## CHECK VALVES allow free flow in one direction

These check valves are designed to allow free fluid flow in one direction and to block reverse flow. Featuring one-

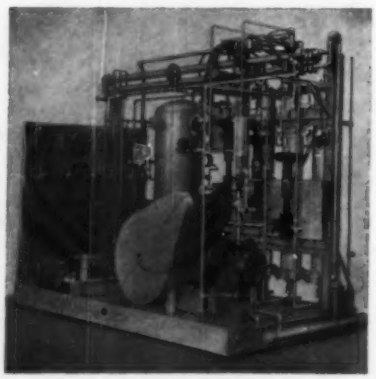


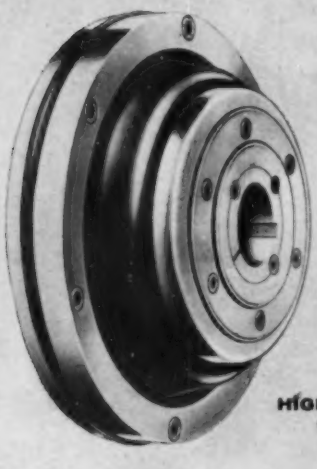
piece, leakproof bodies with a minimum of components, they are constructed with soft seats to assure positive sealing. Simplified design permits large flow passages and in-line construction to minimize pressure drop and prevent loss of power. Design also features a horizontal poppet guide for accurate seating, efficient checking and in-line self-cleaning action. Built for ranges to 5,000 psi, valves are available in brass, steel or stainless steel bodies with ⅛-in. through 1-in. dry seal threads or AND-10050 ports with straight threads. Manatrol Corp.

**▲ For details, circle 27 on Post Card**

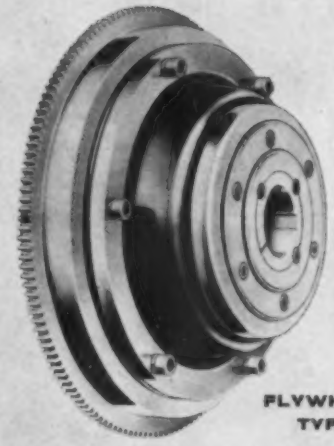
## HYDROGEN PLANT is compact and economical

This new process is said to offer a dependable way to produce relatively pure hydrogen at low cost, and with a fraction of the initial investment required by conventional types of hydrogen generating equipment. Based on research by The Dow Chemical Co. and Armour Industrial Co., the process is two stage. The first stage dissociates the $H_2$ and $N_2$ in commercial anhydrous ammonia using a conventional ammonia dissociator. The second stage employs a continuously cycling adsorption process to separate the $H_2$ from the $N_2$ gas. The process uses liquid or gaseous $NH_3$ and requires only ammonia, gas or oil fuel, electrical power and small quantities of cooling water. Or, the equipment can be altered to





HIGH SPEED TYPE



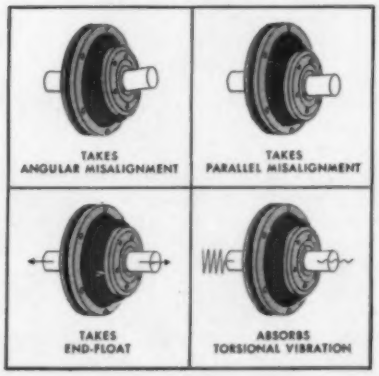
FLYWHEEL TYPE

# NOW! THE COUPLING WITH THE 4-WAY FLEX

## IN TWO NEW TYPES — HIGH SPEED AND FLYWHEEL

STANDARD TYPE

THE 4-WAY FLEX OF PARA-FLEX




DODGE **Para-flex**

Industry asked for this—and here it is! Dodge Para-flex, the unique coupling that swallows up misalignment, is now available for high speed applications, and for high torque at either high or low speed.

The new Dodge High Speed Para-flex is specially designed for operation with motors and internal combustion engines that turn up to 5230 rpm.

The new Flywheel Para-flex, with the same capabilities, has a flexing element that bolts directly to the flywheel of internal combustion engines.

Like the Standard Type (with capacities up to 2000 hp at 1080 rpm) these new Para-flex Couplings feature a modern, tire-like flexing element that handles angular and parallel misalignment, end-float (or any combination) and absorbs torsional vibration. The amazing performance of Para-flex Couplings is a matter of record in thousands of installations.

Ask your Dodge Distributor—or write us for new technical bulletin.

DODGE MANUFACTURING CORPORATION
2700 Union Street, Mishawaka, Indiana

**DODGE**
*of Mishawaka, Ind.*

**CALL THE TRANSMISSIONEER**—your local Dodge Distributor. Factory trained by Dodge, he can give you valuable help on new, cost-saving methods. Look under "Dodge Transmissioneer" in the *white* pages of your telephone directory, or in the yellow pages under "Power Transmission Equipment."

**For more facts circle 615 on Reply Card**

USEFUL INFORMATION
on

# Activated Charcoal

for High Percentage Air Recirculation
and Odor Control

Bring your files up to date with these bulletins on activated charcoal. Just clip this ad and mail it to us.

- ☐ Activated Charcoal for Air Purification
- ☐ How Activated Charcoal "Traps" Odors
- ☐ Air Purification by the Black Magic of Activated Charcoal
- ☐ Fresh Air Costs Money
- ☐ Capacity of Activated Charcoal for Specific Vapors
- ☐ Hospital Odor Control
- ☐ Weigh Odor Control Methods Carefully
- ☐ Air Purification with Activated Charcoal Filterfolds

Activated charcoal acts as a positive molecular sponge which adsorbs gases, vapors, irritants, toxic substances and smog. It enables you to engineer for high percentage air recirculation at low cost.

These and many other bulletins on all applications of activated charcoal are available to you. Give us the details of your application and we will supply specific data and samples.

We supply a complete line of activated carbons for every purpose; design and prefabricate air and liquid purification, separation and recovery systems. Barnebey-Cheney, Columbus 19, Ohio.

Barnebey
Cheney

For more facts circle 616 on Reply Card

## PLANT ENGINEERING EQUIPMENT

(Begins on page 200)

operate simply on ammonia, electrical power and water.

The plants are designed to produce hydrogen from 82 to 98 per cent purity, the balance being $N_2$. Purity is controllable, the cost per 1000 cu ft being higher in the upper purity ranges due to reduced output. All equipment for a 750 scfh plant, except for the ammonia dissociator and dissociated ammonia storage tank, will be about 10 ft high when mounted on a 6-by-12 ft steel skid. It can be shipped piped and wired. An advantage noted is that there is no possibility of the hydrogen being contaminated with CO or $CO_2$. The system can be started quickly; it operates in a range from 25 per cent to full capacity. The Electric Furnace Co.

▲ For details, circle 28 on Post Card

### WEB BELT SLINGS made of nylon and Dacron

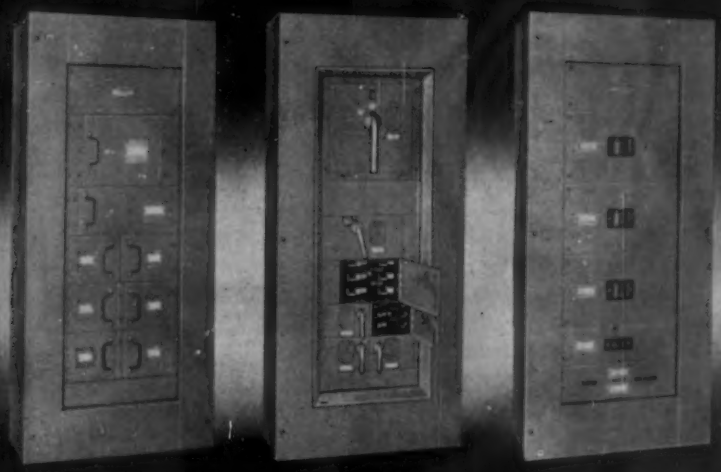
These slings come in a variety of sizes and capacities, in five nylon and five Dacron types and with a selection of fittings. They are intended for use in lifting finished products, machined surfaces and soft metals. According to company, 80 per cent of the slings' reserve strength is concentrated in the inner plies, which are protected from

abrasion by two tough outer plies. Light in weight, unaffected by mildew, rot, bacteria or water, the slings have excellent handling properties at low temperatures, manufacturer notes, and provide safe duty up to 8-10 per cent elongation. Available optionally is a Neoprene coating claimed to increase abrasion resistance by 50 per cent and increase coefficient of friction to a minimum of 2½ times that of other impregnating materials. This coating is reported particularly advantageous when handling objects with polished or slippery surfaces. Nylon slings come

Now there's one just right for any installation...

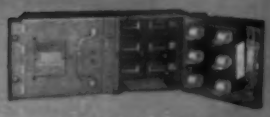
# FRANK ADAM

## Feeder Panelboards



Your preference—with or without doors!

## BRANCHES



**KSF HINGED TYPE...**

Fusible switch, 30 to 600 amps.—250-v. AC or DC; 2 and 3 poles, single and double throw.

**S-A-W TYPE...**

Quick-make, quick-break fusible switch, 30 to 600 amps.—250-v. AC or DC; 600-v. AC, 2 and 3 poles.

**CIRCUIT BREAKER TYPE...**

Automatic protection, 15 to 800 amps.—250-v. AC or DC; 600-v. AC, 2 and 3 poles.

See our catalog in SWEETS

All (FA) feeder panelboards are UL approved.

From Frank Adam's complete line of feeder panelboards you can pick the one that fits your installation requirements perfectly—*with or without a door.*

★ **BIG GUTTERS** simplify wiring, reduce installation time!

★ **"ADD-ON" FEATURE** enables additional branches to be added as needed by merely installing oversize enclosures with blank space covers!

Outstanding and unique "plus" features like these add up to a competitively priced product that gives you more in dependability... more in quality... more in safety. Get the facts—*write for catalog!*

FRANK ADAM ELECTRIC COMPANY

P. O. BOX 357, MAIN P. O. • ST. LOUIS 66, MO.

*busduct • panelboards • switchboards • service equipment • safety switches • load centers • Quikheter*

**For more facts circle 617 on Reply Card**

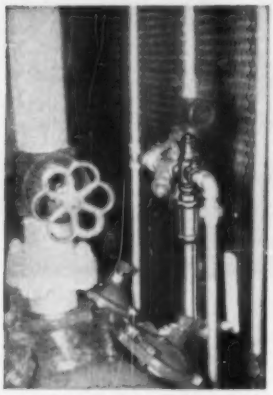
# SARCO TOPICS

## How to save water and prevent over-cooling of compressors, small engines, and hydraulic oil-coolers

When cooling water is controlled manually the operator frequently leaves the valve nearly wide open, in order to play safe if the load varies. The result is over-cooling. If he attempts to vary the flow of water he risks the danger of under-cooling. Automatic cooling controls assure proper cooling at *all* times and effect important economies in water consumption.

And here are three different experiences at Revere Copper and Brass plants which may give you some tips on solving your own cooling control problems.

### How Revere Copper & Brass Saved over 50% on water



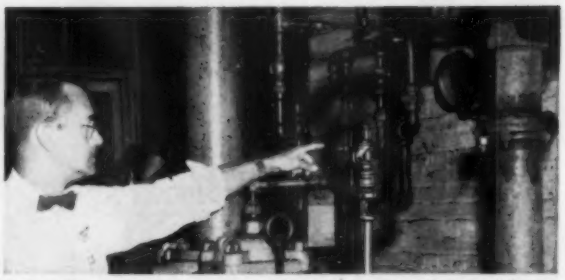
Sarco T-44 automatic cooling control installed at Revere's Riverside plant.

The Riverside, California, plant of Revere Copper & Brass was plagued by over-cooling of compressors. In addition, their water consumption was high — approximately 2,000 gallons an hour. By simply installing Sarco T-44 automatic cooling controls on the compressor cooling lines, plant engineers eliminated over-cooling and cut water consumption about 60%.

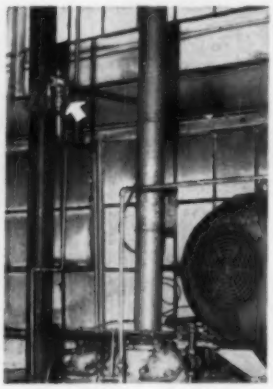
Another benefit was a saving in tool maintenance. (Originally excess moisture was causing difficulty with a large number of air screwdrivers used in the plant.) With the T-44's in service the maintenance problem has practically disappeared.

### Manual control was wasting water at Rome Manufacturing Co. Div., Rome, N. Y.

At the Rome Manufacturing Company Division of Revere, at Rome, N. Y., cooling water for air compressors originally was manually controlled. When they installed Sarco T-44 automatic cooling controls on the cooling water lines they made substantial savings in water. They saved damage and maintenance cost on the compressors, too. That's because they eliminated the errors inherent in manual control. Automatic cooling controls always assure optimum cooling by permitting safe operation at the maximum temperature recommended for any given machine or process.



T-44 cooling control on compressor at Rome Manufacturing Co. Div. of Revere. Sarco sales representative Emile Strickland points to control installations.



Installation of a Sarco T-44 on compressor at Rome, N. Y.

### Water conservation program at Baltimore led to automatic control

Double target of engineers at the Baltimore plant of Revere was a water conservation program plus tighter temperature control. To achieve both objectives they installed Sarco automatic cooling controls on an air compressor, an aftercooler and a hydraulic oil cooler.

Results were so satisfactory they followed through by installing 50 additional Sarco controls.

*For more information on cooling control, contact your Sarco Sales Representative, District office, or write —* 2169

SARCO

SARCO COMPANY, INC.
635 MADISON AVENUE, NEW YORK 22, N. Y.
PLANT: BETHLEHEM, PA.
STEAM TRAPS • TEMPERATURE CONTROLLERS • STRAINERS • HEATING SPECIALTIES

For more facts circle 618 on Reply Card

SARCO

## Inside story on automatic cooling control

Simple, gadget-free design. Fully modulating. Sensitive liquid-filled thermostat gives you uniform movement of valve for each degree of temperature change, at all points on the range. Packless — no stuffing box — no leaks — no valve stem jamming. Self-contained — no part of mechanism exposed. Dependable and inexpensive — thousands in service. So reasonable in cost, you can afford Sarco automatic cooling controls for every application.

Sarco T-44 self-powered cooling control is available in standard 50° adjustment ranges: 60-110° F., 85-135° F., 110-160° F. and 135-185° F. Sizes: ⅜", ¾", ½" and 1".

## For the full story on Sarco Cooling Controls...

contact your Sarco sales representative or district office, or write—

2148

SARCO

SARCO COMPANY, INC.
635 MADISON AVENUE, NEW YORK 22, N. Y.
PLANT: BETHLEHEM, PA.

# PLANT ENGINEERING EQUIPMENT

(Begins on page 200)

in nine standard widths from 1 to 12 in.; Dacron slings, in six widths from 1 to 6 in. Wire Rope Div., Jones & Laughlin Steel Corp.

▲ For details, circle 29 on Post Card

## ELECTRIC UNIT HEATERS 5 to 25 kw sizes

Capacities of these seven electric unit heaters range from 5 to 25 kw, with models available for 208, 240, 277 and 480 v. Casings are styled the same as those of manufacturer's steam and hot water unit heaters. The heating

element consists of steel fins bonded to steel tubes encasing nichrome wires embedded in magnesium-oxide dielectric. A built-in limit control serves to prevent overheating. Motors are suspended from the built-in safety fan guard mounted on the rear of the casing. Units may be suspended from ceiling or wall by means of an optional bracket. Bulletin 1060 supplies information. Modine Mfg. Co.

▲ For details, circle 30 on Post Card

## D-C MOTORS, GENERATORS are totally enclosed

These totally enclosed d-c motors and generators are designed for both constant speed drives and drives involving fast, wide speed changes and reversals, automatic control, or close regulation. The line includes fan-cooled and non-ventilated machines in both industrial and explosion-proof construction. Motors are rated from ½ to 60 hp at 300 to 3500 rpm; generators, from ¾ to 40 kw at 850 to 3450 rpm. Major departures from conventional design noted are: use of a high-temperature silicone insulation system for machines rated and built for continuous operation with a temperature rise of only 75 C (NEMA's new Class B standard for totally enclosed machines); and application of a new high-capacity system of controlled ventilation in which blowers and heat exchangers are mounted at shaft end. Principal advantages claimed are faster response, stability and increased insulation life. Armature inertia has been decreased 75 per cent, company states; and field time constant decreased by 35 per cent. Westinghouse Electric Corp.

▲ For details, circle 31 on Post Card

## BONNET BRONZE VALVES for liquid gas service

Available in gate, globe and angle types, these bronze valves have extended bonnets for liquid oxygen, nitrogen and hydrogen service. They have a Teflon impregnated braided asbestos packing and are degreased and sealed to prevent contamination. A solid Teflon packing can be specified. Stockham Valves and Fittings.

▲ For details, circle 32 on Post Card

## PORTABLE VACUUM can be strapped on the back

The Papoose is a three-way portable vacuum. It may be strapped on the back for use when cleaning overhead pipes and fixtures, or for cleaning in confined areas. For cleaning carpets and floors, there's a one-piece wheel

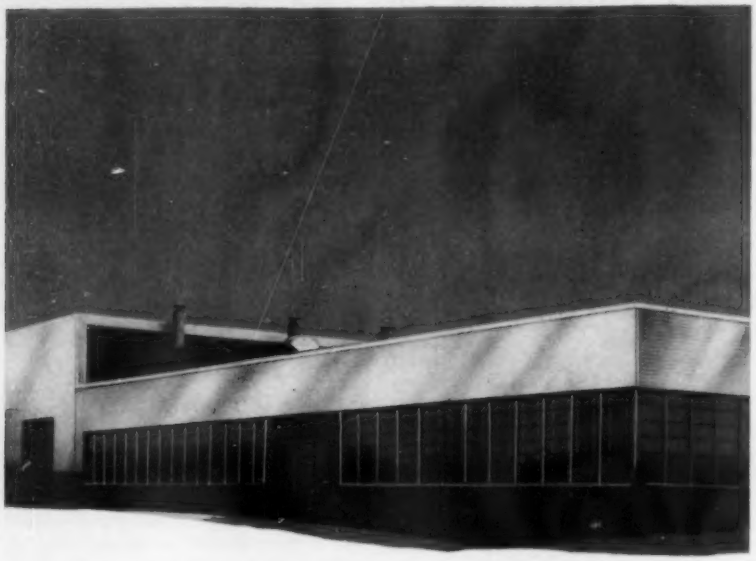
attachment to snap on. Or, the Papoose can be wall mounted for use at work bench and assembly table. It is light in weight, has a 1-hp motor, permanent cloth filter bag of ⅛ bu capacity, high impact Roylite housing and dual turbine vacuum system. It converts to a blower by exchanging the air intake and exhaust plates. Advance Floor Machine Co.

▲ For details, circle 33 on Post Card

## COATING protects metal from rust and exposure

Everwear J-41-B, an all-purpose black coating, is impervious to water and resistant to chemical attack by gas fumes and smoke. Because of its penetrating and spreading qualities, it can be used after minimum surface preparation. It is said to be anticorrosive above or

Atwood Vacuum Machine Company, Rockford, Ill.—showing its re-siding of 4" Ribbed Embossed.



FOR NEW LIFE
AND A BRIGHT NEW LOOK...

REYNOLDS ALUMINUM

Commercial Roofing and Siding

When maintenance men use Reynolds Aluminum to re-cover *other siding that did not stand up* . . . that's evidence of superior rating. For new or old installations, Reynolds Aluminum siding guarantees absolute freedom from rust plus exceptional resistance to corrosive industrial atmospheres.

Reynolds Aluminum roofing completes a building exterior which is practically maintenance-free and which also *reflects radiant heat* . . . improving the comfort of workers the year around, and cutting the costs of heating and air-conditioning.

Available in Corrugated, 4" and 8" Ribbed Embossed, V-Beam and Roof Deck . . . all in natural aluminum *and in 20 New "Colorweld* 60" Colors,* embossed or mill finish. These materials also combined in Field Assembled Insulated Wall Systems. For full information call any Reynolds sales office. Or write to **Reynolds Metals Company,** Richmond 18, Virginia.

**Trademark of Reynolds Metals Company*

Watch Reynolds New TV Show "HARRIGAN AND SON," Fridays; also "ALL-STAR GOLF," Saturdays—ABC-TV.

**For more facts circle 619 on Reply Card**

# PLANT ENGINEERING EQUIPMENT

(Begins on page 200)

below grade. According to manufacturer, J-41-B remains elastic, permitting it to expand and contract with metal during extreme temperature changes. It is suggested for tanks, metal roofs, siding, drains, bridges, beams, girders, cables, steel window frames, machinery, etc. It dries quickly, applies with either brush or spray. Maintenance Inc.

**For details, circle 34 on Post Card**

## SCHEDULING BOARD with magnetic indicators

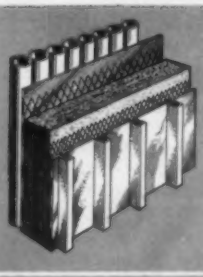
The Rol-a-chart Magnetic is a visual control board offering versatility in scheduling with magnetic indicators that "move with time." Indicators come in six colors, in several sizes and shapes, and are finished with a write-on wipe-off surface. When placed on

the chart's rotating plastic sleeve, the indicators move with the sleeve as it is turned, and thus are brought closer to the line that marks "today." Magnetic index strips give flexibility in arranging index entries. Entries may also be made directly on the plastic-laminated index and the plastic sleeve. The board is steel, finished in gray hammertone. It comes with wall hangers, folding easel, carrying handle and red and black marking pencils. A sample chart section is offered to plant engineers. Conley, Baltzer & Steward.

**For details, circle 35 on Post Card**

## RADIANT HEATER provides foot level comfort

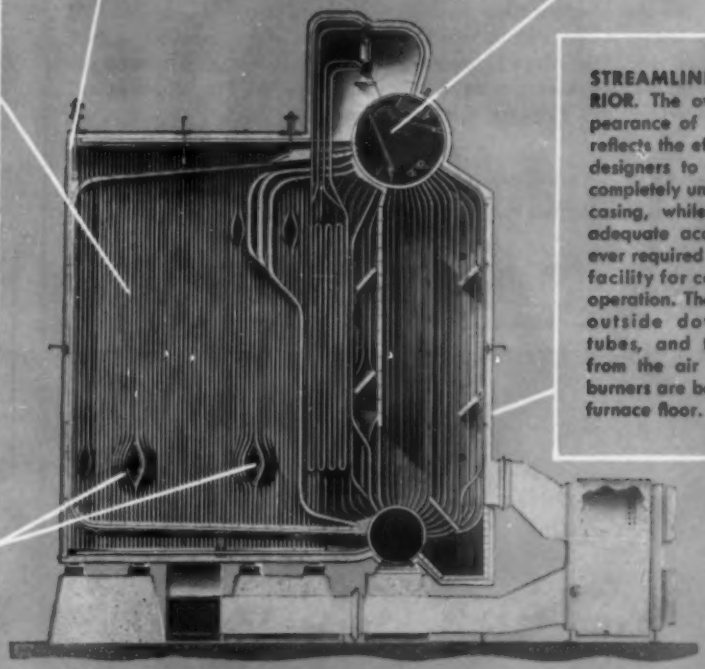
This UL-approved radiant heating device is designed to keep employees' feet warm in plant and office areas where floors are cold, damp, or chilly.



**PRESSURE-TIGHT, SKIN CASING.** A service-proved method of casing construction for pressure-fired boilers in the size class of the VU-55, this casing is designed to assure lifetime tightness with minimum heat loss. Pressure firing permits the elimination of an induced draft fan with its attendant operating and maintenance costs. Wall construction consists of tangent tubes backed up successively with welded steel panels, 4 inches of high quality insulating material and an outer steel casing formed as shown to provide adequately for expansion and to give a neat, finished appearance.

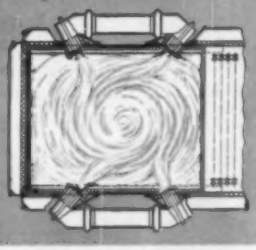
**HIGH STEAM QUALITY.** The VU-55 has generous water capacity and steam reservoir space. Its drum internals are exceptionally effective in producing high quality steam at all ratings.

**TANGENT FURNACE TUBES.** The VU-55's furnace tube arrangement provides complete heat-absorbing, water-cooled protection on all furnace walls. Furnace maintenance is minimized, refractory expense is eliminated.



**STREAMLINED EXTERIOR.** The over-all appearance of the VU-55 reflects the efforts of its designers to achieve a completely unobstructed casing, while retaining adequate access wherever required and every facility for convenient operation. There are no outside downcomer tubes, and the ducts from the air heater to burners are beneath the furnace floor.

**TANGENTIAL FIRING.** More than 20 years of application experience have established the exceptional advantages of tangential firing. About 90 percent of Combustion's large utility installations use this advanced method of firing. Flame streams from the four burners impinge upon one another at high velocity, as shown, creating a turbulence unattainable by any other method of firing. The result is rapid and complete combustion. As the gases spiral upward, they sweep all furnace heating surfaces, assuring a high rate of heat absorption.



# The VU-55 Boiler...

## *a "standardized" boiler with "custom-built" performance*

The C-E Vertical-Unit Boiler, Type VU-55, is designed to bring central station type of performance to the "standardized" boiler market.

It combines a number of time-tested and service-proved features such as Tangential Burners, pressure-tight casing and tangent furnace tubes. This bottom-supported unit requires no outside supporting steel, is economical of space and has an uncluttered, streamlined appearance.

The VU-55 is available in a series of sizes ranging in capacity from 70,000 to 150,000 lb of steam per hour. It is designed for three pressure ranges (250,500 and 750 psi) and can be equipped with a superheater to provide temperatures up to 800 F.

The VU-55 Boiler is symmetrical in design, performs efficiently over a wide range of output, and is easy to operate and maintain.

When you are considering additional steam capacity in the quantity range mentioned above don't fail to consider the VU-55.

**COMBUSTION ENGINEERING**

General offices: Windsor, Conn. New York offices: 200 Madison Ave., New York 16, N. Y.

Canada: Combustion Engineering-Superheater Ltd.

C-261A

all types of steam generating, fuel burning and related equipment; nuclear reactors; paper mill equipment; pulverizers; flash drying systems; pressure vessels; soil pipe.

**For more facts circle 620 on Reply Card**

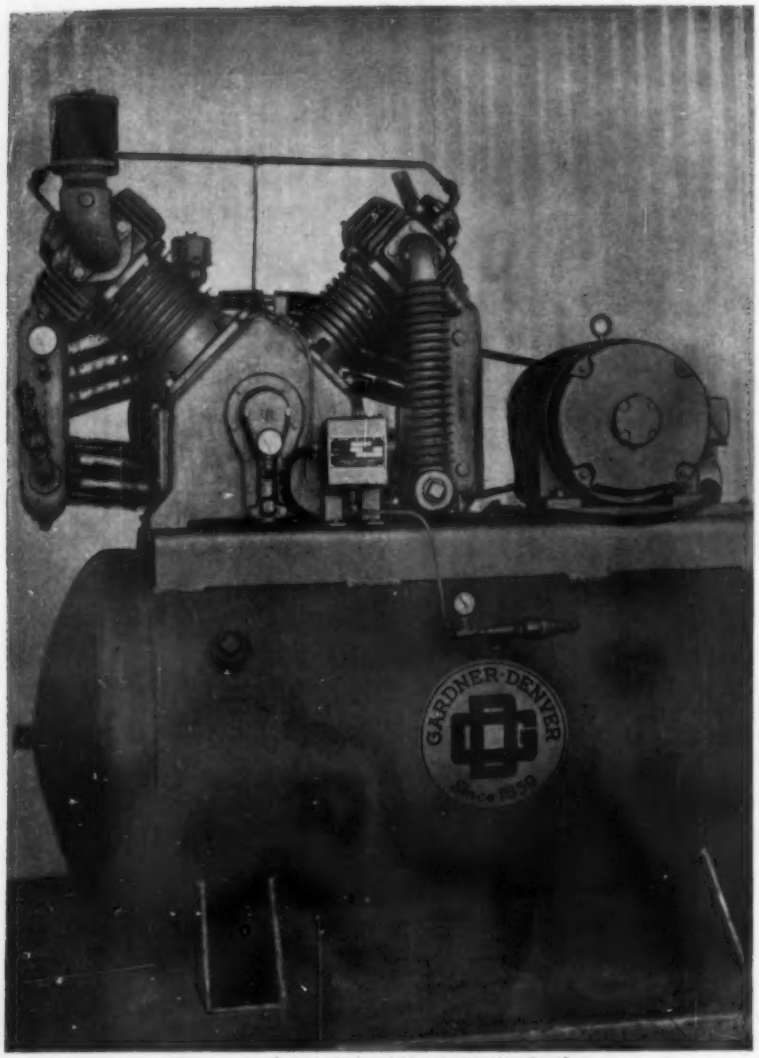
EQUIPMENT TODAY FOR THE CHALLENGE OF TOMORROW

GARDNER-DENVER

Here's one of the highest-capacity tank-mounted compressor outfits available—to provide low-cost air without adding a more expensive type of installation. It's the Gardner-Denver ADL—a two-stage, air-cooled, 20 hp, two-cylinder unit. In continuous service, it has a piston displacement of 100 cfm at 870 rpm. Discharge pressure up to 125 psi, or as high as 250 psi on intermittent service. Compressor alone also available. For information, write Gardner-Denver Company, Quincy, Illinois.

# High-capacity outfit

## for low-cost air




For more facts circle 621 on Reply Card



# PLANT ENGINEERING EQUIPMENT

(Begins on page 200)

The unit automatically provides a 10-deg increase in temperature at floor level. Constructed of Masonite, the heater measures 20-by-24-by-5/16 in. and operates from 120 v, single phase, 60 cycle—10 hr for 2 cents in most areas, company states. It is noted that since there are no exposed wires or open flames, the units can be operated in hazardous or wet locations. Individual heaters cost about $14. MacNeal & Dashnau.

▲ For details, circle 36 on Post Card

**It's easy to obtain product data with the postage-free Reader Service Cards provided on pages 255-256. Use them for information on advertised products, too. Just circle the key number appearing on bottom of the ad.**

### POWER SWEEPER for abrasive, conductive dusts

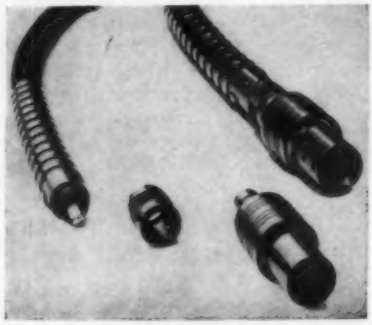
Model 40-DP is a walk-behind power sweeper designed for areas exposed to abrasive and conductive dusts. Traveling at speeds to 3 mph, it cleans a 34 in. path, has self-propelling action and stops automatically when operator releases handle. Features announced include dry type air filter for engine,

with increased dust-filtering efficiency; 72 per cent increase in filter area, to 21.5 sq ft; sealed spark plug, cable, and breaker points to prevent ignition shorts when sweeping up conductive metallic dusts; and dust-protected, shielded and sealed bearings. It is designed for congested, dusty areas. G. H. Tennant Co.

▲ For details, circle 37 on Post Card

### FLEXIBLE SHAFT has quick-disconnect feature

The HD Flexible Shaft is designed for applications requiring a portable source of power that can be connected and disconnected very fast (such as at test stands). Using the spring ball



method, the flexible shaft can be connected or disconnected at either power source or drive component. It has built-in high-speed ball bearings at each end and couplings that can be bored to suit and attached with set screws. Available in ⅜-, ½- and ⅝-in. core, maximum torque capacity of 220 in.-lb. Stow Mfg. Co.

**For details, circle 38 on Post Card**

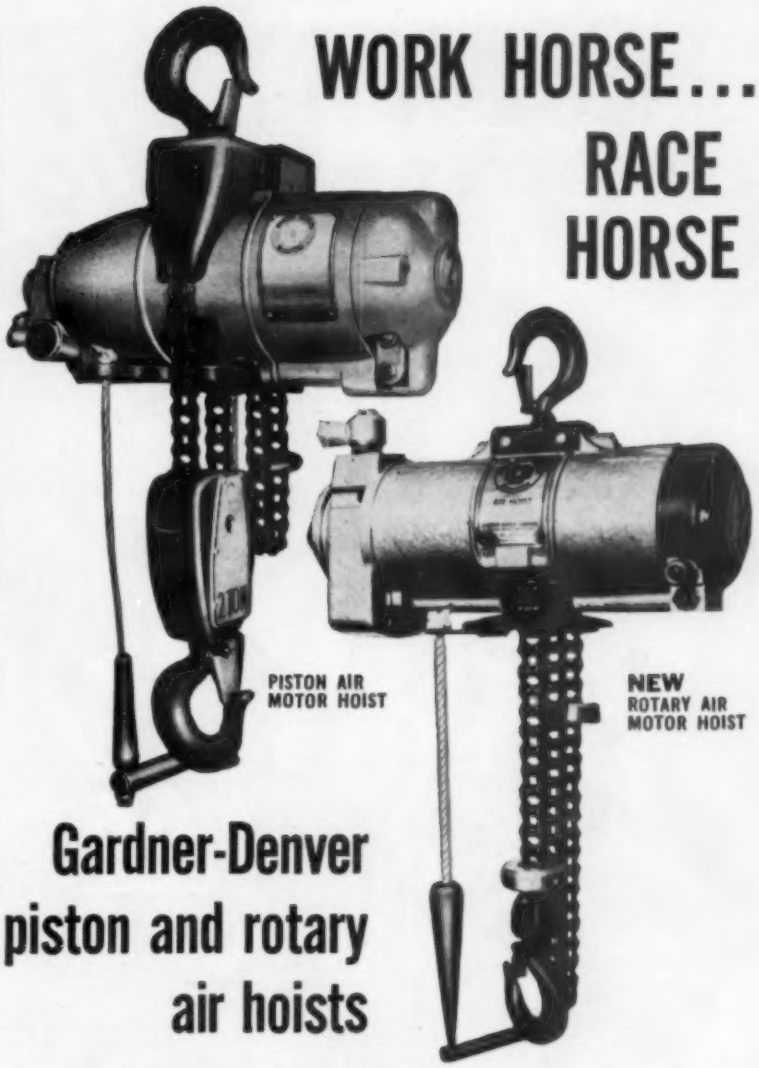
### STATIONARY BATTERY is extra powerful unit

Because it is so powerful and will last an estimated 20 yr in float-charge service, the EHGS Exide-Ironclad costs considerably less per ampere hour per year than conventional Plante and flat-plate stationary batteries, according to manufacturer. And because it stores more power in a given space and is more efficient for its weight, it is reported to save up to 64

per cent of floor and mounting-rack area and up to 55 per cent in weight.

The new battery incorporates a tubular-type positive plate design. The tubular plates, with Silvium grids, are described as 30 to 60 per cent thicker than those of batteries with flat pasted plates. Teamed with the new positive


WORK HORSE... RACE HORSE




Gardner-Denver piston and rotary air hoists

Only Gardner-Denver offers lightweight overhead air hoists for *both* the "work horse" and "race horse" jobs. Axial-piston hoists provide rugged, dependable operation with the control demanded for precise spotting. That's why hundreds of industrial plants rely on this Gardner-Denver hoist. New rotary air hoists are designed for use where the combination of speed and ruggedness is of primary importance—up to 90 fpm in 500-lb. capacity.

**Popular models available from 150-4000 lb. Sparkproof construction and pendent control available.**

| PISTON HOISTS | | | | ROTARY HOISTS | | | |
|---|---|---|---|---|---|---|---|
| MODEL | CAPACITY | SPEED | WEIGHT | MODEL | CAPACITY | SPEED | WEIGHT |
| 86-1V10 | 1000 | 19 | 28 | 86R-5 | 500 | 90 | 27 |
| 86-2V20 | 2000 | 19 | 78 | 86R-10 | 1000 | 40 | 27 |
| 86-2V40 | 4000 | 10 | 100 | 86R-20 | 2000 | 20 | 30 |

EQUIPMENT TODAY FOR THE CHALLENGE OF TOMORROW

GARDNER-DENVER

Gardner-Denver Company, Quincy, Illinois

In Canada: Gardner-Denver Company (Canada), Ltd., 14 Curity Ave., Toronto 16, Ontario

**For more facts circle 622 on Reply Card**

DISCOVER THE LONG-TERM ECONOMY OF TOP QUALITY WITH

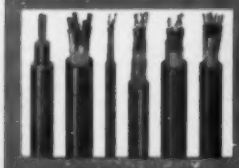
BRONCO 66 CERTIFIED

BRONCO Certified 66 NEOPRENE

PORTABLE ELECTRICAL CORDS AND CABLES

"An investment in continuous production!" are the words used by one plant superintendent to express his satisfaction with Bronco 66 Certified. "Nothing we've got around our plant—and we've got plenty of oil, acids, and ozone,—and sunlight out in the yard—ever seems to bother that 67% jacket. We've got to keep our tools turning, when we figured the savings in down-time saved, we found Bronco 66 cord costs us nothing at all."

It's the extra Neoprene that puts the brawn in Bronco 66. The outer protecting jacket is certified by a Registered Professional Engineer to contain not less than 67.32% neoprene—highest in the industry. That's what gives maximum protection against the enemies of rubber found in your factory. Jacket is branded with complete identifying data by a patented (U. S. Patent 2867001) Bronco process, vulcanized in so it won't rub off.



For your every portable cord and cable need there's a Bronco 66 Certified product . . . Heavy Duty Type SO Cords, Heavy Duty Type W, and G (with ground wires) Cables, 300 volt Type SJO Cords, Type SO cords and cables specially engineered for use on payout and retractable reels, Control Cables, High Voltage Cables for 3 KV and 5 KV service, Welding Cables, Motor Lead Wires . . . They're all work-savers because they're so flexible; time-savers because they're so dependable.

*Write for your free copy of the complete Bronco Catalog of Electrical Wires and Cables.*

*Bronco products are sold through Electrical Wholesale Distributors, available overnight or sooner from a nationwide network of warehouses. Let us take care of your unusual length requirements.*

BRONCO WESTERN

BRED FOR STAMINA

WESTERN INSULATED WIRE COMPANY
Los Angeles 58, California

For more facts circle 623 on Reply Card

# PLANT ENGINEERING EQUIPMENT

(Begins on page 200)

plates to deliver full power at high discharge are pasted negative plates that are 9 to 20 per cent thicker than usual. Assembled in a transparent polystyrene jar, the EHGS Exide-Ironclad comes in 10 sizes, with capacities at the 8-hr rate ranging from 200 to 800 amp-hr. Exide Industrial Div., The Electric Storage Battery Co.

▲ For details, circle 39 on Post Card

## TEMPERATURE CONTROL is low cost, rugged unit

This thermocouple-operated potentiometer controller (R7086) is described as a "rugged workhorse" in controlling heating operations in a wide range of industries. Heart of the electronic control system is a transistorized amplifier-relay panel containing operating controls and circuitry. Temperatures are sensed through a heat-sensitive

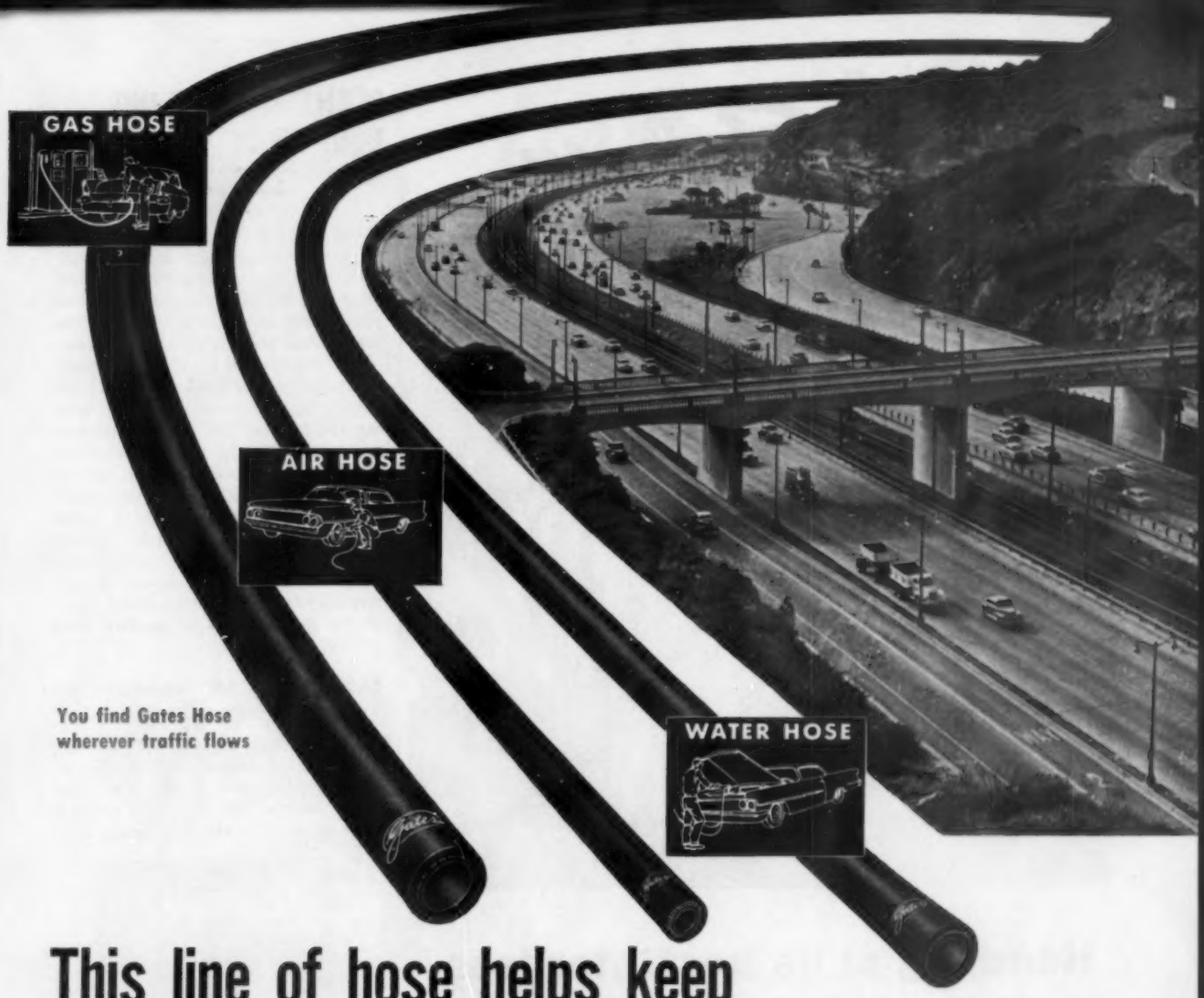
thermocouple inserted into the medium to be controlled. Accurate temperature control is reported possible with resistances of as much as 20 ohms in the lead wire between controller and thermocouple. Temperature adjustments are dialed on the cover of the 9-by-10 in. panel. Lights indicate if power is on and whether temperatures are above or below set point.

The non-indicating controller includes a built-in proportioning unit to prevent "temperature over-shoot." Temperatures from −200 to 2000 F can be controlled within 4 deg, company says. The controller costs around $150, with thermocouples extra. Minneapolis-Honeywell Regulator Co.

▲ For details, circle 40 on Post Card

## RESIN COATED SAND for shell molds or cores

Wedron 7020, a highly flowable round grain sand usually used for cores, and Whitehead Grade E, a sub-angular




# This line of hose helps keep 70,000,000 vehicles on the move

**To service some 70 million motor vehicles with gas, air, water and grease, this nation's 183,000 service stations use uncounted miles of hose. Because Gates is a major manufacturer of industrial hose, thousands and thousands of these stations rely upon Gates Curb Pump Hose, High Pressure Grease Hose, Air, Water and Low Pressure Steam Hose.**

In back of this broad acceptance of Gates Hose is a continuing program of specialized hose research at the multi-million dollar Gates Research Center. The aim of this *specialized research* is to increase hose utility, lengthen hose life and lower industry's annual hose costs.

Because Gates Hose is so widely preferred, it is quickly available from leading distributors in all industrial centers. These Gates Hose Distributors are listed in the phone book Yellow Pages.

TPA502

**The Gates Rubber Company**

The Mark of *Specialized* Research

## Gates Industrial Hose

Made in a Full Range of Types and Sizes

For more facts circle 624 on Reply Card

# AP Safeway

## PORTABLE ELEVATING TRUCKS

## Handling at its best...for less

Here's how to handle twice as much, in the same time, with the same crew! Put AP *Safeway* Trucks to work *now*. Pedal-operated and battery-powered . . . 46″ to 130″ lift . . . built-in stability for loads up to 2000 pounds . . . engineered so operators raise, lower position and stack loads with less effort.

Your AP savings begin with initial cost and extend to operating costs, which are far lower than for heavy-duty motorized trucks. And rugged, compact AP design gives both *big-truck dependability* and *small-truck maneuverability*—the unmatched combination for highest handling economies in time, storage space, and maintenance.

Get full details from your AP-Franchised Distributor. Call him today!

**AP Load Jockey® POWER ATTACHMENT**

An AP "super-special" engineered to take the heavy work and high costs out of horizontal handling. New, exceptionally efficient, hydraulic drive attachment for portable elevating trucks.

THE AMERICAN PULLEY COMPANY
4200 WISSAHICKON AVENUE • PHILADELPHIA 29, PA.
*A division of VAN NORMAN INDUSTRIES INC.*

2589

For more facts circle 625 on Reply Card


# PLANT ENGINEERING EQUIPMENT

(Begins on page 200)

sand producing economical high strength shells or cores, are now available resin coated. According to manufacturer, the coating process utilized offers four advantages: sand grains are coated uniformly; sand develops higher tensile and hot strength; melting point can be advanced to the required degree without extensive mixing and mulling; and residual solvents are trapped in the resin to create a lumping sand condition and prevent free flow. Standard melt point will be 200 to 250 F. A lubricant is in the sand to provide for easier release from pattern, it is noted, and in many cases no additional spraying of patterns is needed. Bennett-Ireland, Inc.

▲ For details, circle 41 on Post Card

## ELECTRIC CAR speeds in-plant transportation

This one-battery electric car seats one man and equipment, weighs 181 lb, has a low center of gravity and a safe speed limit of 4½ mph, and operates with accelerator and foot brake. It is

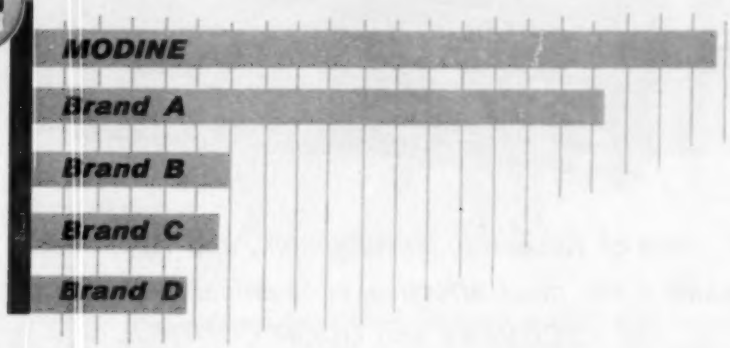
just 35 in. wide, narrow enough to get through a tight aisle. Car is suggested for plant executives, supervisors, maintenance men, messengers, spot checkers and other personnel required to move from one place to another in plant, warehouse, etc. Battery powers car for 10 miles, and car carries its own charger for recharging overnight. Cost is under $400. Birdie Co., Inc.

▲ For details, circle 42 on Post Card

## CHEMICAL PELLETS for melting ice and snow

Extreme heat is generated by these chemical pellets immediately on contact with moisture, yet, used as directed, they are claimed harmless to grass, shrubs and other vegetation,

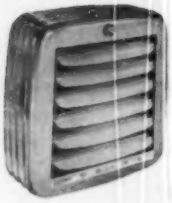
# Leading the field!




# MODINE

## steam and hot water unit heaters

**HORIZONTAL**
Can be direct-from-pipe suspended . . . without other supports. Vertical louvers may be added for complete directional control. 24 sizes.



**VERTICAL**
Available in 28 sizes . . . choice of 4 air deflectors. Depending upon size selected, mounting height may vary from 10 to 60 feet.

**POWER-THROW®**
For hard-to-heat locations. High-velocity discharge assures exceptionally long heat-throw . . . up to 140 feet. Offered in 10 sizes.

The chart shows the results of a brand preference survey made by a leading industrial magazine. In a poll of *men who buy* steam and hot water unit heaters, Modine finished well out in front.

Since the 1920's, Modine has been the industry pace-setter . . . in performance, styling, economy. Features of today's Modine line include: three distinct designs . . . horizontal, vertical, Power-Throw; lightweight, yet extremely durable construction; high capacity on steam *or hot water* systems; die-formed casings; a complete line of low-outlet-temperature models for high pressure systems; extra-heavy die-formed fins for added strength and maximum heat transfer; vertical fin design that discourages accumulation of dust and dirt.

**CATALOG 158** *has complete information. See your distributor or write Modine Manufacturing Co., 1563 DeKoven Ave., Racine, Wisconsin.*

***Immediate delivery from local stock!***
Modine wholesalers are located in all principal cities. Call the Modine representative nearest you . . . he's listed in the yellow pages.

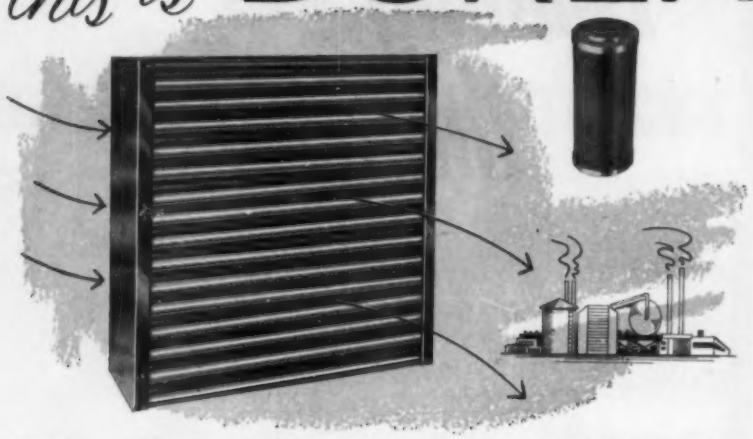
SU-1389

**Also from the world's most complete unit heating line**

Modine
FIRST NAME IN UNIT HEATING

**For more facts circle 626 on Reply Card**

# *this is* DOREX



*27 years of Research, Development, and Application make it the most effective, economical method of AIR RECOVERY and ODOR CONTROL*

## WHAT DOREX IS . . .

Dorex equipment is designed in two basic types—C Cells and H Canisters—Dorex acts exactly like a gas mask, using activated carbon to adsorb air-entrained odorous, gaseous, and vaporous irritants and impurities. As a direct result of the carbon's highly effective purging action, stale and/or contaminated air is purified and reconverted to its original healthful freshness, ready for sanitary re-use in air conditioning systems. The Dorex process eliminates the biggest obstruction to maximum economy in air conditioning.

## HOW DOREX WORKS . . .

Dorex efficiently solves the several air pollution problems menacing business, industry, and the general public: purification of severely contaminated intake air (smog); purification of recirculated air; purification of contaminated exhaust air.

## WHERE DOREX IS USED . . .

Dorex is used throughout business and industry, in combination with air conditioning and ventilating systems . . . in office buildings, department stores, food processing plants, distilleries, electrical and electronics plants, atomic energy labs, paper factories . . . virtually anywhere that polluted air creates severe problems of offensive odor, equipment corrosion, and toxic atmospheric conditions.

## WHY DOREX IS THE MOST EFFECTIVE

Dorex engineers always select the type of carbon that years of Connor research and experience have proved is most successful in different given situations. There is *no single all-purpose* type of activated carbon that can be applied successfully in all air recovery and air purification situations.

*CONNOR... for Constant Comfort Conditions*

*Request—on your letterhead, please—copies of Dorex Bulletin 108A and the authoritative air purification textbook available only from Connor, "Air Conservation Engineering".*

CONNOR ENGINEERING CORPORATION

DANBURY • CONNECTICUT

CONNOR ENGINEERING CORPORATION dorex® air recovery

For more facts circle 627 on Reply Card


## PLANT ENGINEERING EQUIPMENT

(Begins on page 200)

concrete, asphalt or tires. Suggested for use on driveways parking areas, roads, streets and sidewalks, loading docks, railway switches, sewers, gutters and downspouts, pellets can be applied by sprinkling with scoop, shovel, spreader, dispenser or by hand. Revere Chemical Corp.

▲ For details, circle 43 on Post Card

### FASTENING CLAMP holds two tubes at right angles

Right-Angle Tube Clamp is designed to hold two pipes or tubes of different diameters at right angles. In model illustrated, a threaded bolt is passed through one pipe and drawn up. Tightening the nut causes clamp's jaws

to tighten on both pipes at once. This model requires perforation of one of the pipes for bolt. In other models, a different type of engagement is provided to eliminate need for holes in pipes carrying fluid. Applications include temporary plumbing, light scaffolding, experimental fixtures, hand rails, barriers, area partitions, sign boards, clothing racks, electrical ground connections, and hangers for lighting. Hunter Spring Co., Div., American Machine & Metals, Inc.

▲ For details, circle 44 on Post Card

### COOLING UNITS powered by natural-gas engines

Three basic cooling units are included in this line: a package liquid cooler unit for water cooling systems, a refrigeration condensing unit series, and an engine compressor unit. All are described as money savers because the natural gas they use offers a low cost energy source in many areas, and all parts, except the gas-operated motor, are made by one company. Also, the

# THE BRIDGE TO *Progress* AND *Safety*...

**The bridge in this picture, designed to carry both horse power and man power across the Root River, represents a step to further expansion of Western Printing and Lithographing Company facilities in Racine, Wis.**

Western selected Globe's Safety GRIP-STRUT grating on this bridge for greater safety and for greater economy. Safety GRIP-STRUT is the new basic material, all in one piece (including channels), not welded, riveted or expanded, in steel or aluminum, in standard sizes and gauges. It presents an open space, in a diamond pattern, in excess of 55% of the area for a positive NON-SKID footing in all directions. It is also ideal for work platforms, stair and ladder steps, flooring, balconies, catwalks, machinery guards, fire escapes and for original equipment safety treads.

**IMPORTANT SAFETY FEATURES:**

**Fire proof, slip proof, maximum strength, minimum weight, easy to stand and walk on, cool in summer, warm in winter.**

**BIG ECONOMY FEATURES:**

**For balconies—no extra light needed below—no extra heat. No extra supports needed—Channels are integral part of the material. No secondary sprinkler heads necessary. Self cleaning. Cut and installed like lumber by your own maintenance force. Low in original cost.**

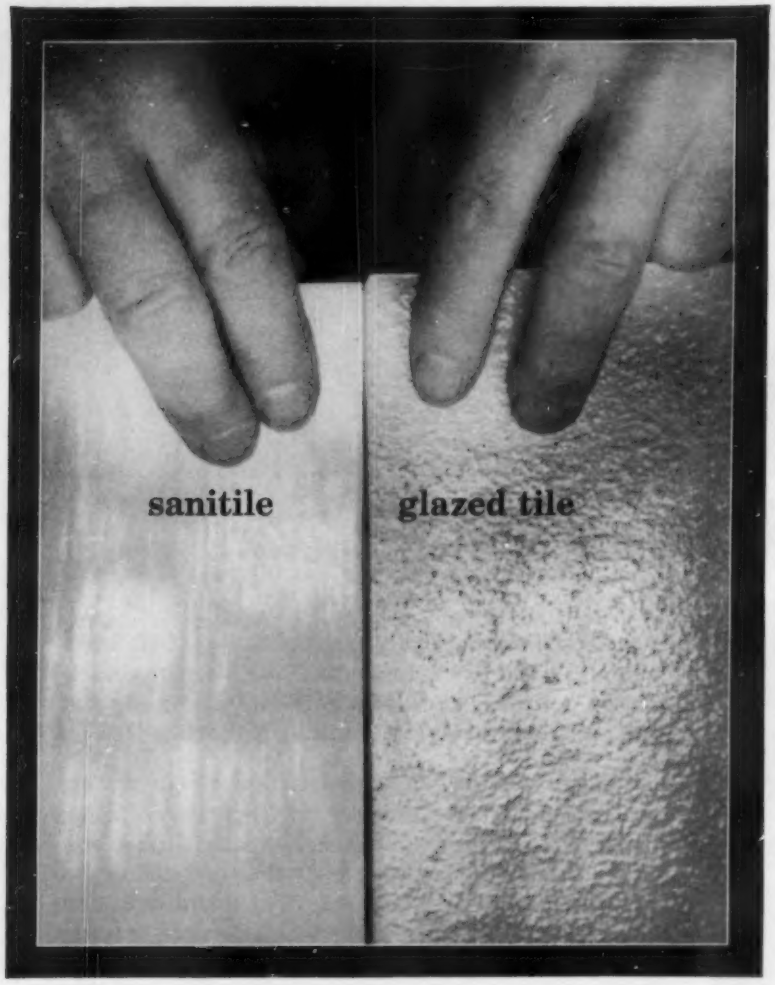
*Write for new complete catalog. Distributors in all principal cities. Consult yellow pages in phone book under "GRATING".*

116

**PRODUCTS DIVISION** | *The Globe Company*

**4016 S. PRINCETON AVENUE • CHICAGO 9, ILLINOIS**

**For more facts circle 628 on Reply Card**




# GLEAMING SANITILE WALLS
## at 1/15th the cost of tile

**SANITILE** transforms your plant into a gleaming show place... creates a sparkling, tile-like surface over present walls and ceilings... produces the sanitary advantage of tile at 1/15th the cost of tile. Sanitile is applied by brush, spray or roller by your own help... without processing stoppage... saves the cost and inconvenience of 2 to 4 repaintings. Used throughout the world by leading food processors.

**SANITILE** meets exacting sanitary requirements for smooth, washable, hard surfaces over cement block, brick, plaster and composition board. Sanitile resists steam hosing, condensation, water, acids, alkalies, oils and greases... checks and resists fungus, mould and bacteria. Write for booklet AIA 23G, *The Master Mechanics Co., Cleveland 28, Ohio, or The Master Mechanics Chemicals Co. (Canada) Ltd., Toronto 14, Ontario.*

THE MASTER MECHANICS COMPANY

For more facts circle 629 on Reply Card

# PLANT ENGINEERING EQUIPMENT

(Begins on page 200)

units are said to operate more quietly because the gas motors create less vibration than most types.

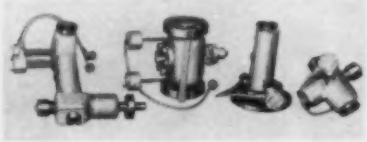
The liquid cooler unit is a complete cooling package, containing compressor, condenser, heat exchanger, centrifugal pumps and evaporator. It's enclosed in a steel frame and is entirely automatic. The compact refrigeration condensing unit series includes 12 units of 7½- to 150-ton capacities. To simplify maintenance, they are bolted, rather than welded. The engine compressor unit has an infinite modulation range from 1800 to 1200 rpm. Its lubrication supply oils the unit for 2000 hr, a full season's operation. Bell & Gossett Co.

▲ For details, circle 45 on Post Card

**Use the Reader Service Cards provided on pages 255-256 to ask for more information on this equipment. Circle item numbers of products in which you are interested.**

## ELECTRIC HEATERS for use on pipes, valves, tees

Pipe Thermaheaters are designed for valves, reducers, tees, crosses and special pipe assemblies and can be

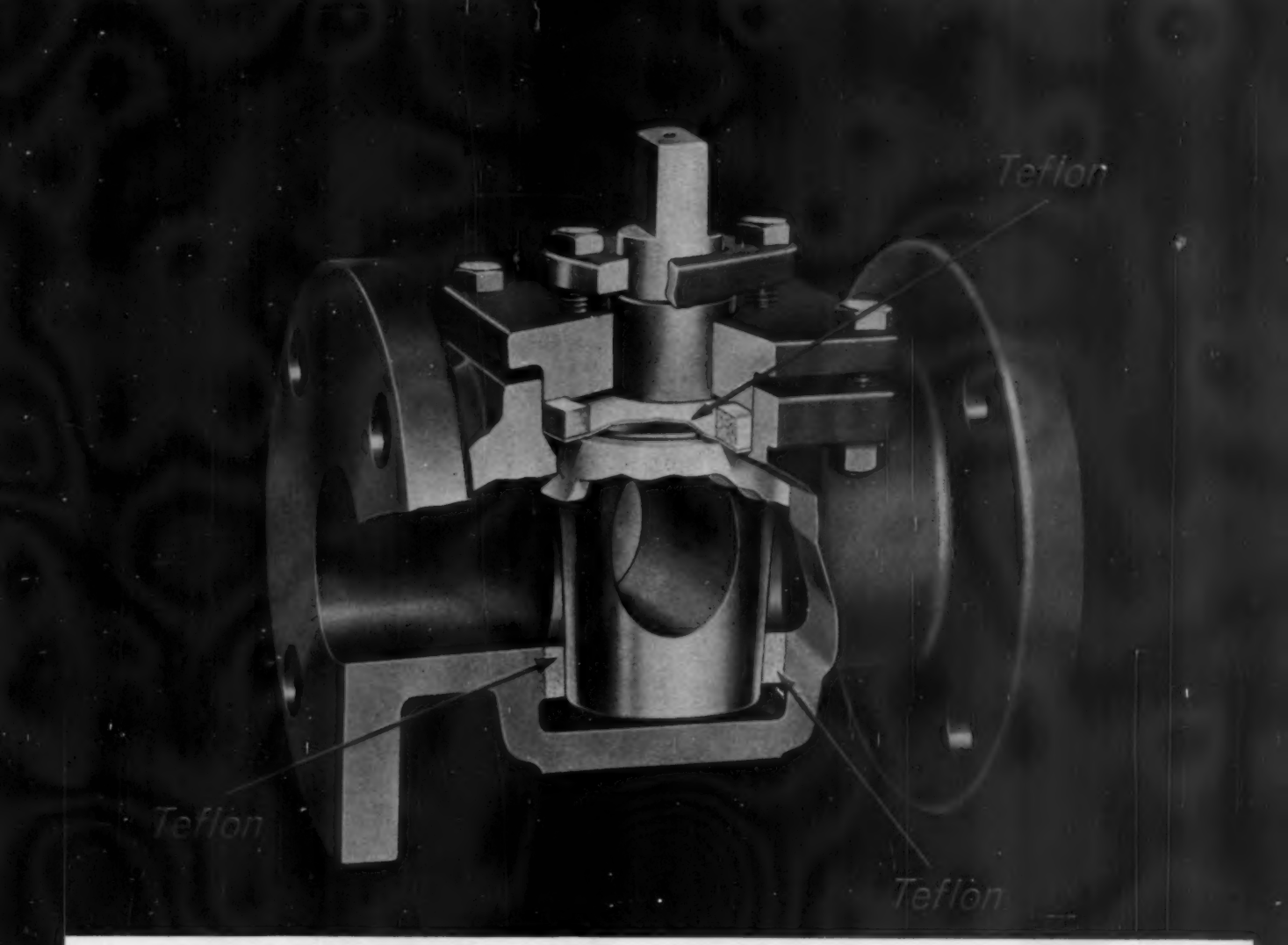


furnished with explosion-proof boxes. The heaters are cast aluminum and can be applied on cast iron or stainless steel pipe up to 20-in. pipe size. Many sizes, shapes, voltages and practical wattage can be supplied. Thermel, Inc.

▲ For details, circle 46 on Post Card

## CENTRIFUGAL BLOWERS with design improvements

Key to the redesign of the BC (backward curve) line of centrifugal blowers is a fan wheel structure incorporating mechanical changes. It features a deepened inlet cone and welded, backward curved, spun wheel shrouds. The design for both single and double width wheels also allows for finer tolerances between stationary and mov-




# THROW OUT LUBRICATED PLUG-VALVE PROBLEMS

## Install non-lubricated DURCO Type G Sleeveline valves

Wherever you have cast iron or semi-steel valves that stick, gall, break, leak thru, or otherwise cause maintenance nightmares, install ductile iron Durco Type G valves with Teflon sleeves.

Durco Sleeveline valves are available in ductile iron or stainless steel, screwed or flanged ends, from ½" through 6", with 150 psi rating.

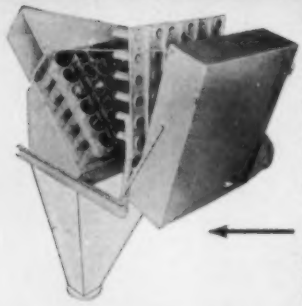
Write today for your copy of Bulletin V/12.

DURCO
CORROSION RESISTING ALLOYS & EQUIPMENT

**THE DURIRON COMPANY, INC.**, Dayton, Ohio / Valves • Pumps • Filters • Process Equipment

**For more facts circle 630 on Reply Card**

# THERE'S THE RIGHT KIND OF DUSTEX COLLECTOR for every dust problem*

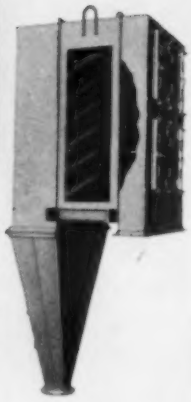


**DUSTEX CENTRIFUGAL COLLECTORS** →

D-584 with 100% efficiency at 14 microns

D-560 with 100% efficiency at 12 microns

for economical separation of dust from normal or high temperature gas or air.

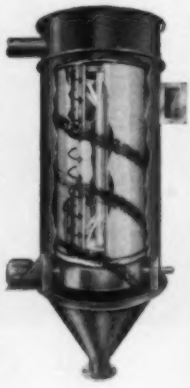


← **MICROCLONE**

with 99.8% efficiency at 10 microns and smaller for ultra-high efficiency and installations requiring strict sanitation . . . easily cleaned and sanitized thanks to convenient hinged top tube sheet design.

***For Many Ordinary Dusts***

New, Low-Cost DUSTEX "1600" brings a higher Dustex Performance to collectors in Lower Price Range.



**DUSTEX ROTO-JET CLOTH COLLECTOR** →

Dustex Engineering eliminates usual cloth problems through a completely new design . . . drastically lowers operating and maintenance costs.

***THE BIG DIFFERENCE***

**IN CENTRIFUGAL COLLECTION**

**Dustex Exclusive Patented Design**

- Unobstructed inlet plenum avoids material buildup and plugging.
- All tubes are surrounded by cleaned gases and maintained at system temperature to forestall condensation and plugging when systems are above dew point.

**IN CLOTH COLLECTION**

**Revolutionary Dustex Advances**

- Preliminary separation of dust reduces cloth load.
- No reversing mechanisms.
- Unique controlled wrap prevents cloth jamming.
- Cloth changes easier . . . less frequent.

***For all Hopper and Bin Discharges***

**(Under Negative Pressure)**

**DUSTEX VACUUM VALVE**

No motive power required.
No mechanical parts.
Maintenance free.
Bolt in place and forget it.

**ON THE JOB DETERMINATION TEST YOUR BEST GUARANTEE**

The Dustex Single Tube Determination Test, performed under actual operating conditions, provides exact data with which to specify equipment. No cost or obligation.

**SEND FOR** "A Simplified Test Method", illustrated booklet describing the Dustex Single Tube Determination Test in detail.

Details and specifications for every model available on request.

***DUSTEX PATENTED FEATURES ARE THE BASIS FOR DUSTEX SUPERIOR PERFORMANCE***

*It will pay you to learn why Dustex has so successfully handled so many process dusts where other collectors have failed.

*The company with the big name in dust collection . .*

dustex CORP.

P. O. BOX 2520 • BUFFALO, NEW YORK

**For more facts circle 631 on Reply Card**


# PLANT ENGINEERING EQUIPMENT

(Begins on page 200)

ing parts. Efficiency is increased while fan noise is reduced, manufacturer states, and other benefits include lower initial cost, versatility, due to rotatable housings up to size 625 and split housings for easy wheel removal on larger sizes. The fans are designed to move small, medium and large quantities of air, from 344 to 725,840 cfm, from ¼ to 6 in. static pressure. Applications range from air conditioning systems to processing such as in malt houses, cement plants, plating for fume exhaust, drying at temperatures to 850 F. Benefits derived offer lower rpm with equal capacities. Bayley Blower Co.

**For details, circle 47 on Post Card**

## TRANSLUCENT PANEL of fiber glass and metal

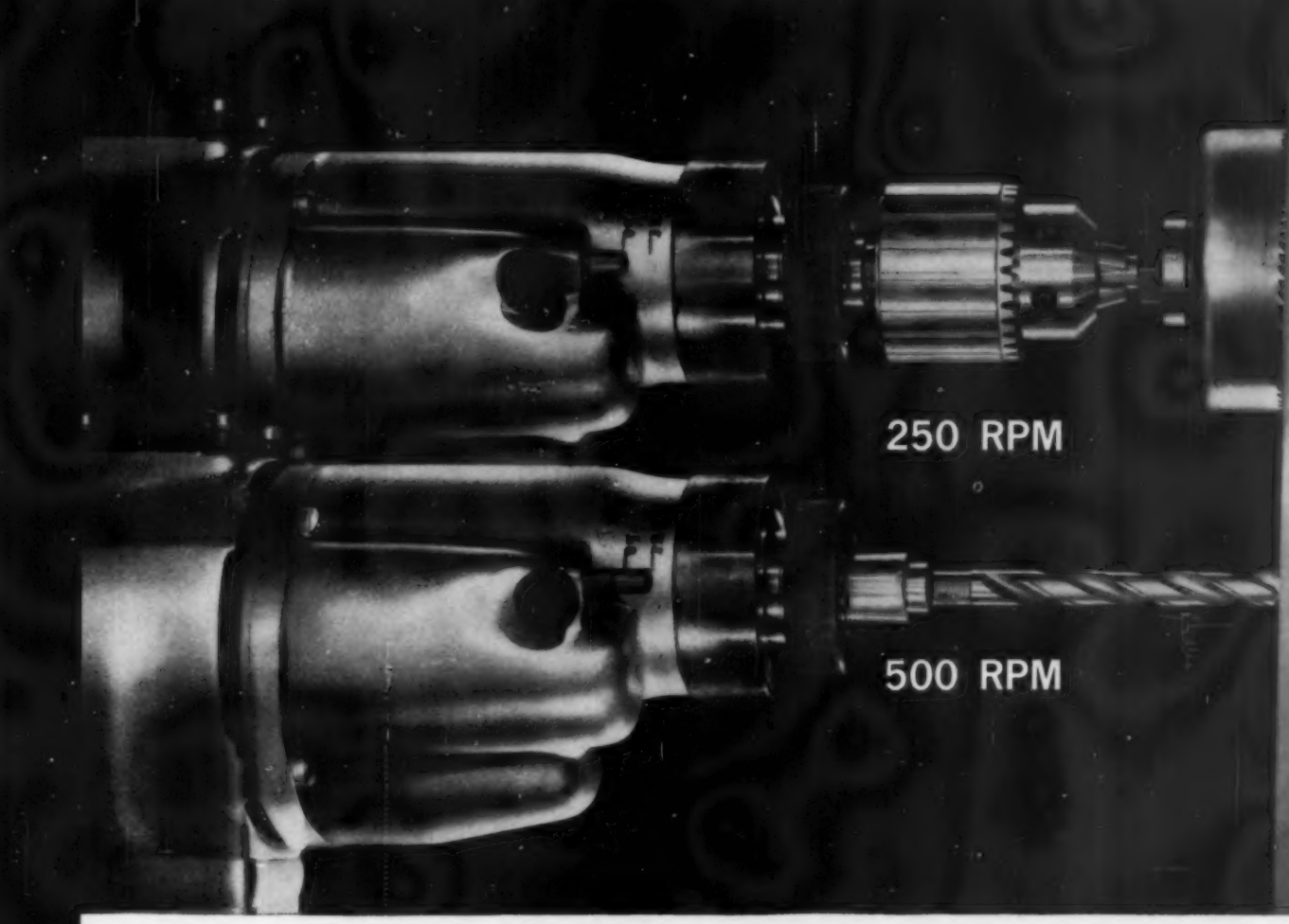
Chem-Guard is a protective panel of translucent press-molded fiber glass with expanded metal embedded in the panel for strength and decorative effect. According to company, panels

offer high impact resistance and maximum light transmission without undesirable glare. They are designed to reduce maintenance and replacement costs in industrial glazing and other applications. A variety of colors are available. Chemold Co.

**For details, circle 48 on Post Card**

## PNEUMATIC TRANSMITTER measures flow, liquid level

This pneumatic transmitting bellows flowmeter is described as having unusual temperature stability. Units come in indicating and non-indicating models featuring a flapper-nozzle pneumatic circuit, pilot valve with controlled bleed, and Ni-Span C rebalancing capsule which, due to its zero thermoelastic coefficient, reduces zero and span shifts to less than 0.5 per cent per 50 F ambient change. Units feature modular




# NEW 2-Speed drill has the versatility to do more jobs more efficiently!

Hole sawing . . . masonry work . . . core drilling . . . reaming . . . *any* production drilling job is a cinch with B&D's new precision-balanced Two-Speed Drill. Celebrated B&D engineering even allows you to use this ruggedly built tool as a *separate* power unit. Switch the clutch control and it automatically changes from 500 RPM for high-speed work to 250 RPM for extra-power drilling. Reverses easily too!

You'll appreciate the way B&D reserve power flows out over the heavy-duty roller bearings to give you the *precise* speed for effortless production work . . . the way work speeds through your shop, dramatically reducing your labor and down-time costs. See how B&D's Two-Speed Drill can do your jobs faster, with *less* fatigue . . . with *more* profit! Sold by leading distributors everywhere. *For sales or service look in the Yellow Pages under* TOOLS ELECTRIC

**Black & Decker®**
CUTS MAN-HOURS TO MINUTES

**NEW Two-Speed Black & Decker Magnetic Drill Press**
equipped with the new 1¼" Two-Speed unit operates manually or by exclusive remote control. Work against the ceiling, right side up, or sideways. Gets into tight spots easily, rapidly. Also ¾" (single speed) model.

THE BLACK & DECKER MFG. CO., Dept. 0811
Towson 4, Md. (In Canada: Brockville, Ont.)

☐ Please arrange for a demonstration of.....

☐ Please send me more information on.....

Name.....Title.....

Company.....

Address.....

City.....Zone....State.....

☐ IMPACT WRENCHES ☐ HAMMERS ☐ SANDERS ☐ SAWS

**For more facts circle 632 on Reply Card**

# "What have you done about this DUST?"

In our plant trouble is spelled D-U-S-T. And our plastics production V.P. wanted to know what I had done to get rid of it. He was mad, and frankly, I didn't blame him. Dust was costing us a lot of money each year—in machine wear, misalignment and down time—to say nothing about absenteeism and poor morale among the workers. How could the plant help but be dusty—with grinders, lathes, milling and molding machines running 16 hours a day.

But I explained that I had checked on several dust control systems. The problem was that in 6 months we planned to expand and re-model the shop. It seemed like throwing good money after bad to invest in a control system now. But the V.P. wanted action. He told me about a Torit engineer who had called on him claiming he had a dust control system that offered complete *flexibility.* Then he gave me his card and suggested I call him immediately.

Believe me, I called that Torit man, but fast. He explained to me the flexibility his system offered—how with just minor changes it could be adapted to the new plant layout. I bought one of his Torit Model 24 Cyclone machines for less than $1,000. It services 2 molding machines, a double-end grinder, 2 lathes and a milling machine. And it really performs—has practically eliminated the dust in our shop. We're finishing our expansion and I have ordered another Torit Dust Collector to service our additional machines. You'd hardly recognize our shop now. It's clean. Production is up—morale is up—absenteeism is lower than ever.

*Cyclone Model 24*

*Torit can solve your dust problems. For complete facts on dust . . . and how to control it . . . write*

**TORIT manufacturing company**

*1133 Rankin St., St. Paul 16, Minn., Dept. 1832*

**For more facts circle 534 on Reply Card**

## PLANT ENGINEERING EQUIPMENT

(Begins on page 200)

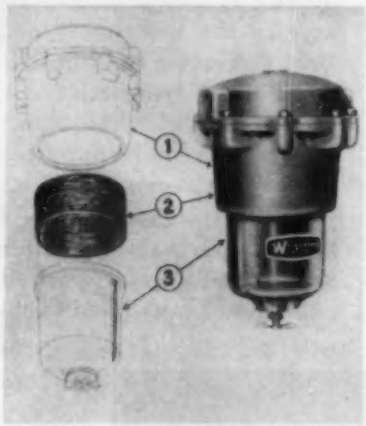
construction — each component can be independently removed by sliding the concentric scale indicator free from the fluorescent-tipped pointer. Span, zero and linearity can be adjusted without disassembly.

The transmitter is designed to provide two-way overload protection while the flow meter itself can take full static pressure overload in either direction. Rotation of the 5-in. diam indicator is on a 270 deg arc. The case, 9 in. high, is die cast aluminum with reinforced Fiberglas cover. The bellows type differential pressure meter is available in models for measuring liquid level in closed tanks under pressure or vacuum and for flow or open tank measurements. Brown Instruments Div., Minneapolis-Honeywell Regulator Co.

**▲ For details, circle 49 on Post Card**

### COMPRESSED AIR FILTERS of larger bowl capacity

As illustrated, an extra casting is incorporated between the cover and the bowl of the Pure-Flo Filter. This casting houses the filter cartridge and enables use of a larger-than-usual cartridge. Filtering area of the cartridge in the ½-in. PT size, for instance, is 17.5 sq in. Because the air has this increased surface through which to travel, less pressure drop results, it is explained, and more air can




flow through. The additional casting for the cartridge housing also serves another purpose. The cartridge is entirely out of the filter bowl (in many filters 75 per cent of the bowl storage area is taken up by the filter cartridge) permitting full storage capacity in the bowl. The latter is designed to hold

☐ IMPACT WRENCHES ☐ HAMMERS ☐ SANDERS ☐ SAWS

For more facts circle 632 on Reply Card

# SAVE SPACE

## WITH NEW GENERAL ELECTRIC SAFETY SWITCHES

Lugs for either copper or aluminum wire (60 to 600 amp.).

Bottom-hinged and front-operated for close ganging.

Visible blades are spring-reinforced to assure full, firm contact; minimum joints in current path; silver-plated copper parts; no fiber linkages in mechanism.

Clear ON-OFF indication from over 100 feet. Ratings plainly shown on permanent metal nameplate.

HEAVY DUTY ▲

▼ LIGHT DUTY

Safety phase barriers guard against accidental contact with live parts.

General Electric's new safety switches bring you important savings in space, longer service life, maximum safety and more economical installation. And Heavy Duty (Type A) switches sell at Normal Duty (Type C) price levels. Write for Bulletin CPD-74. See your nearest G-E distributor for a demonstration.

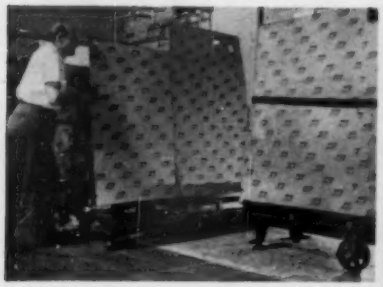
**GENERAL ELECTRIC**

Circuit Protective Devices Dept., Plainville, Conn.

For more facts circle 634 on Reply Card

# MATERIALS-HANDLING NEWS

NEW AND UNUSUAL APPLICATIONS OF BASSICK CASTERS THAT MIGHT BE ADAPTED TO YOUR HANDLING PROBLEMS



## "Easy to Maneuver"

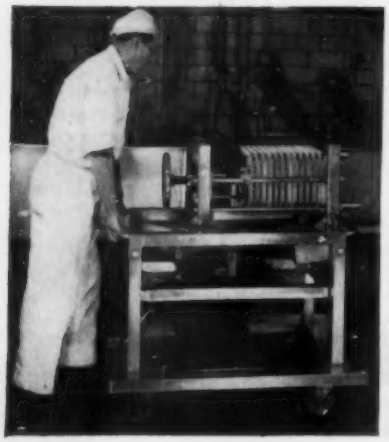
...is the way to describe the specially designed carts used in this plant to handle large, heavy sheets of plastic. Two heavy-duty Bassick series "78" casters at the center of each cart take the main part of the load. Two smaller Bassick series "77" casters at each end prevent tipping. The large size and roller-bearing construction of these casters makes rolling easy despite floor irregularities. The "two-wheel" design facilitates end-for-end turns and similar maneuvers.

Bassick truck-locks firmly anchor these carts in a fixed position when desired.

## Filter for Kodak... Mobility by Bassick

Bassick casters give mobility to this portable filter press. It's used to filter various ingredients in connection with the manufacture of photographic paper at Kodak Park Works, Rochester, New York—the largest manufacturing unit of the Eastman Kodak Company.

Bassick has a wide variety of casters for use under conditions of laboratory cleanliness. Some can be steam cleaned.



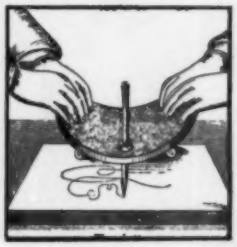
## *Tobacco Company Rolls Its Own*

Bassick casters play a big part in the warehouse operations of this large tobacco company (which wishes to remain anonymous). Using caster-equipped dollies, handlers can quickly and easily move huge hogsheads and bales of tobacco from point to point, or load them on fork-lift trucks for longer hauls.

These simple materials-handling aids are equipped with rugged Bassick series "33" roller-bearing swivel casters. Series "33" casters are inexpensive, and they're ideal for industries—like tobacco—where the heat of drying ovens may prevent the use of ball-bearing swivel casters.

This is just one of the many casters available from Bassick. The wide Bassick line can almost always offer you a standard caster that's *exactly* right for your needs.

## Easy Rolling "Ghost Writer"



This illustration of a planchette clearly shows a set of casters to aid in producing "spirit writing" when several people placed their hands on the device.

It just goes to show the enormous variety of jobs that casters can facilitate. See whether Bassick casters can speed up, make more convenient, or cut costs in, *your* operations.

## Quality Casters Can Slash Maintenance Costs

Is your net profit caught in a squeeze between price and costs?

Maintenance is a big cost item in many plants, warehouses, stores and institutions. Bassick casters can help you reduce maintenance in two ways: (1) the right Bassick caster gives longer service, cutting caster replacements, and (2) the right caster wheel will protect and save your floors.

### See your Distributor

He carries a large selection of Bassick casters in stock for fast deliveries. And, if you have special materials-handling problems, he's in the best position to advise you because he sells from the widest caster line on the market. O.35

THE BASSICK COMPANY
BRIDGEPORT 5, CONN.
IN CANADA:
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Sweet's

Symbol of SW Excellence

Bassick
A DIVISION OF
STEWART-WARNER CORPORATION

For more facts circle 635 on Reply Card

## PLANT ENGINEERING EQUIPMENT

(Begins on page 200)

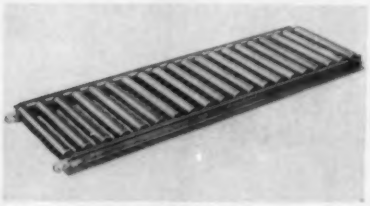
half a pint of contaminants before draining is necessary.

The filter cartridge is an impregnated felt material which is rigid. Company says it filters out particles as small as 5 microns, and can be cleaned in a solvent and re-used. Metal parts are Zamak and the bowl is available in transparent plastic or metal for air pressures to 250 psi, temperatures to 250 F. The Pure-Flo comes in pipe thread sizes from ¼ through 5 in. for air flows from 16 to 3100 cfm at 100 psi. Circulars 1023 and 1026 give full information on the filter. Wilkerson Corp.

▲ For details, circle 50 on Post Card

### GRAVITY CONVEYORS with steel or aluminum frames

These aluminum and galvanized steel frame roller type gravity conveyors feature maximum load capacities to 1000 lb for the 5-ft steel frame sections,



and up to 800 lb for the same size aluminum sections. Track sections are available in 5- and 10-ft lengths in 12-, 18- and 24-in. widths. Curved sections are supplied to match. Rollers are furnished in five spacings from 3 to 12 in., depending on material to be moved. Castored portable supports, aluminum gates, package stops are available. Hytrol Conveyor Co., Inc.

▲ For details, circle 51 on Post Card

### HYDRAULIC JET CLEANER for walls, floors, equipment

In the Super Booster Jet Cleaner, a mixing chamber of venturi injector assembly uses ordinary plant steam and water to produce a powerful, high velocity jet discharge stream for cleaning areas up to 50 ft away. Three models—Super 5, Super 30 and Super 80—enable use of plant steam pressures of 5 to 150 psi. With such plant steam, and inlet water pressures from 10 to 40 psi, discharge hot liquid jets are boosted four to 20 times inlet steam to produce hose pressures from 100 to 630 psi. Design of these hydraulic

"Tough buyers" demand Reznor

# REZNOR DUCT FURNACES

## cut installation and maintenance costs

*Note the features that make Reznor duct furnaces more adaptable, cut installation time and costs:*

- mounting pipes at all four corners permit easy suspension or base mounting;
- double-lip flange simplifies air-tight connections;
- air can flow through heat exchanger in either direction;
- controls can face each other when heaters are in tandem;
- built-in draft diverter is reversible;
- flue collar is interchangeable for horizontal or vertical installations.

*These features insure long-run economy, easy maintenance:*

- Reznor furnaces have long-lasting, corrosion-resistant aluminized or stainless steel heat exchangers and non-clogging steel burners, easily accessible from front or rear;
- every furnace is flame-tested and shipped complete with U/L approved controls.

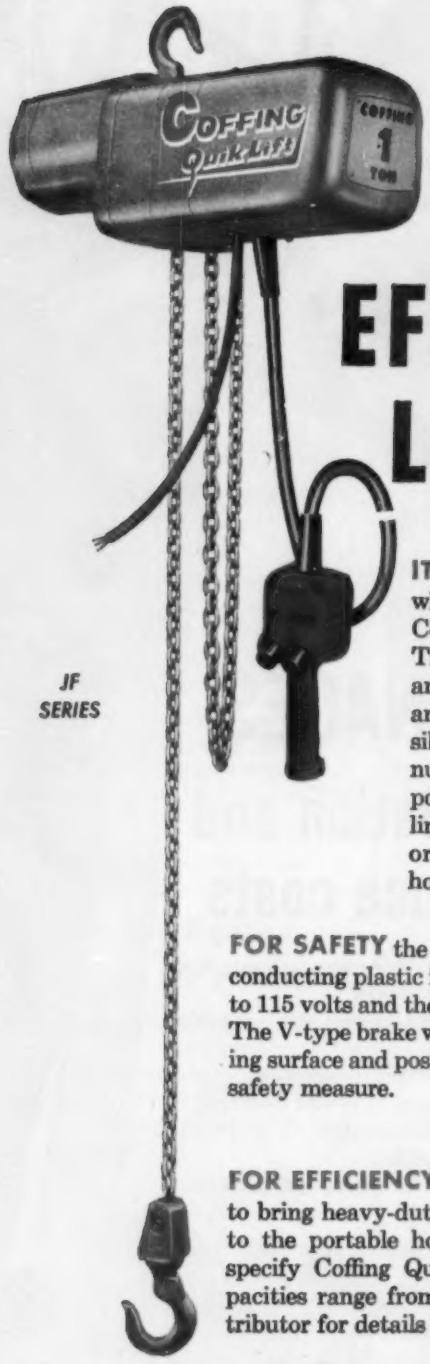
Whatever system you're planning—central heating, year-round air conditioning, make-up air, process air—Reznor fills any requirement. Heaters may be used singly in capacities up to 300,000 Btuh, or in tandem or side-by-side arrangement for greater heating requirements. Reznor blowers available. Ask your Reznor representative for Catalog SA-5900. Or write Dept. 91V, Reznor Manufacturing Co., Mercer, Pa.



# REZNOR HEATERS

"WORLD'S LARGEST SELLING DIRECT-FIRED HEATERS"

For more facts circle 636 on Reply Card




JF SERIES

# EASY SAFE EFFICIENT LIFTING!

**IT'S EASY** to raise or lower loads while pulling a trolley mounted Coffing Quik-Lift Electric Hoist. The pistol-grip control station and the combination strain cable and control cord makes this possible. The light but strong aluminum housing provides ease of portability. Changing voltages, limit switch, type of suspension or chain is quick because the housing is in sections.

**FOR SAFETY** the control station is made of non-conducting plastic in which the voltage is reduced to 115 volts and the push-buttons are interlocked. The V-type brake which provides maximum braking surface and positive control of loads is another safety measure.

**FOR EFFICIENCY** this hoist has been designed to bring heavy-duty performance plus durability to the portable hoist field. It will pay you to specify Coffing Quik-Lift. Twenty models—capacities range from ¼ to 2 tons. Ask your distributor for details or write for Bulletin ADH-65.

# COFFING HOISTS

**DUFF-NORTON COMPANY**

Four Gateway Center · Pittsburgh 22, Pa.

COFFING HOISTS

Ratchet Lever • Air
Hand Chain • Electric

DUFF-NORTON JACKS

Ratchet • Screw
Hydraulic • Worm Gear

For more facts circle 637 on Reply Card


## PLANT ENGINEERING EQUIPMENT

(Begins on page 200)

scrubbing units permits mixing of detergents with the hot water jets in adjustable amounts up to 25 per cent of volume. Detergent or solvent is picked up from a drum or tank and drawn automatically, without an auxiliary pump, into the mixing chamber of the cleaner. Units have 50 ft of ¼ in. Neoprene hose, cleaning lance with handle, and nozzle with two all-purpose interchangeable discs. Sellers Injector Corp.

▲ For details, circle 52 on Post Card

### ELECTRIC TRUCK takes short turns in narrow aisles

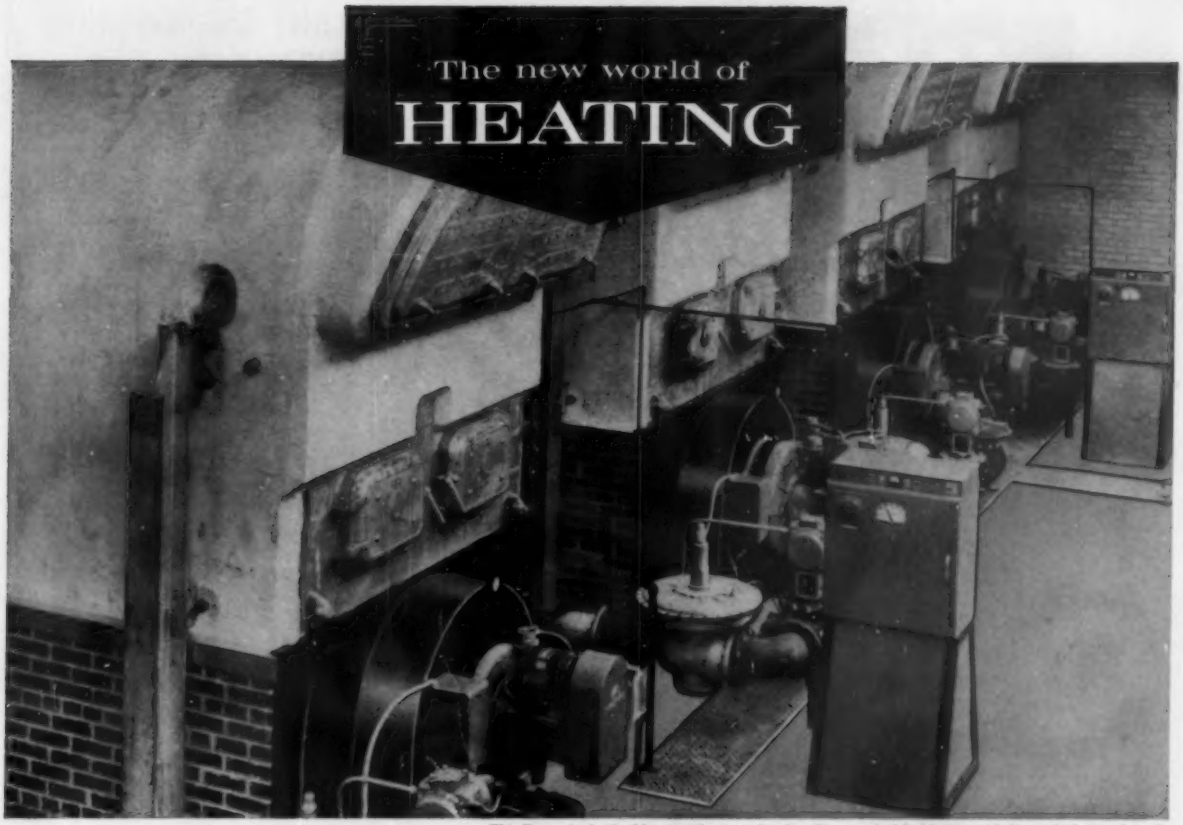
Short turning radius and maneuverability give the F-26TA-2 maximum efficiency in narrow aisle operations. The electric industrial truck is designed for fast tiering of unit loads

under restricted warehousing conditions. Equipped with automotive type controls, trucks feature natural driving position. Inner uprights and elevator carriage are roller mounted to reduce wear and power loss. Capacity is 2000 lb with 48-in. load; a 3000-lb capacity truck is also available. Elwell-Parker Electric Co.

▲ For details, circle 53 on Post Card

### ORGANIC BIOCIDES for cooling water treatment

Dearcides are announced as highly effective against harmful organisms, but low in toxicity to humans. According to manufacturer, they do not create dust or fumes and have such a high flash point that fire hazards are minimized. They are soluble in all types of water, company says, and are non-corrosive, and compatible with sulfates, phosphates, chlorides or carbonates in the water. Dearcide 702, for treating injection water for secondary oil re-




*This Kansas high school heating plant uses four Iron Fireman dual-fuel burners with factory-built control panels.*

# Add high efficiency firing *without boiler alteration*

**Factory engineering replaces local "cut and try" firebox design**

The Iron Fireman AirRing* dual-fuel burner (shown in the high school heating plant above) is a complete factory built package that is simply bolted to the boiler front.

The package includes both primary and secondary air systems, combustion safety controls, ignition and fuel systems for either one or two fuels, and factory engineered refractory combustion throat.

This compact unit not only reduces on-the-site construction, but achieves superior performance by supplementing local craftsmanship with experienced application engineering. Complete combustion is accomplished without flooding the firebox with excess air.

This cutaway shows how oil, gas and air are introduced into the combustion chamber through a single firing port. No checkered floor, firing arch or boiler pit. Flame is generated within a cone of air—no inefficient infusion of underfloor air.

**Trade-Mark*

*Mail coupon for full information and specifications.*

# IRON FIREMAN

HEATING AND AIR CONDITIONING
AIRCRAFT COMPONENTS AND EQUIPMENT
MISSILE AND AIRPLANE GYROSCOPES
ELECTRONIC EQUIPMENT
CONTROL INSTRUMENTS

Iron Fireman Mfg. Co., 3070 W. 106th St., Cleveland 11, Ohio
(In Canada, 80 Ward St., Toronto)

Please send complete technical description and specifications on Iron Fireman AirRing firing.

Name_____

Firm_____

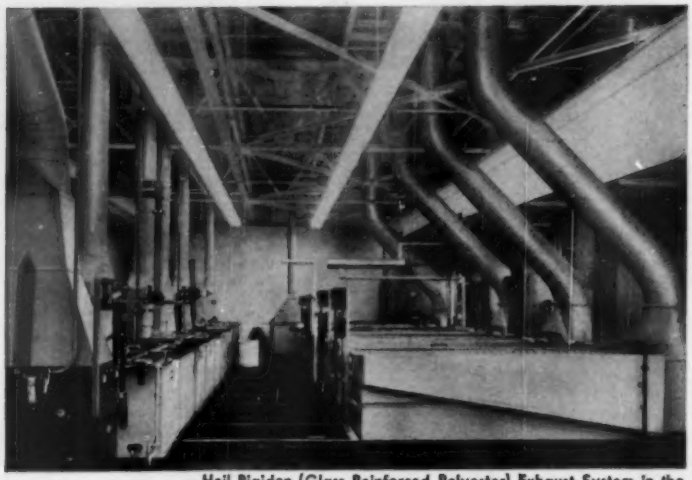
Address_____

City_____ State or Prov._____

**For more facts circle 638 on Reply Card**

HEIL of Cleveland

# PLASTIC VENTILATING SYSTEM at *Western Electric* plant



Heil Rigidon (Glass Reinforced Polyester) Exhaust System in the Plating Room of Western Electric Company's New Omaha Plant.

## *features attractive appearance, high strength, long life, easy installation and complete corrosion resistance*

Western Electric Engineers wrote the specifications. The ventilating system for their plating room must look as modern and attractive as all other parts of their new plant. The system must positively resist exposure to fumes and the splash of acids and alkalies. It must be sturdy and rigid; and combine long life, low maintenance, be easy to install or re-arrange, and low in first cost. The Heil Rigidon system pictured above met all these requirements.

Heil Centrifugal and Axial Rigidon Reinforced Plastic Fans.

Heil Fume Scrubber and Rigidon Duct Work.

**In your plant also,** Heil service-proved plastic ventilating equipment will definitely cut the costs of handling corrosive fumes. Complete line, including collecting hoods, ducts, fans, stacks and fume scrubbers in Rigidon (reinforced plastic) or Rigivin (rigid vinyl) construction. Wide range of standard sizes speeds delivery and minimizes engineering costs.

**Write today for Bulletin No. B-500. It lists chemical resistance data and specifications of standard sizes of equipment that can be installed by your own maintenance men or local contractor.**

CHEMICAL-PROOF LININGS · TANKS HEATERS PLASTICS

**HEIL PROCESS EQUIPMENT CORPORATION**

**12940 Elmwood Ave. • Cleveland 11, Ohio**

**For more facts circle 639 on Reply Card**

# PLANT ENGINEERING EQUIPMENT

(Begins on page 200)

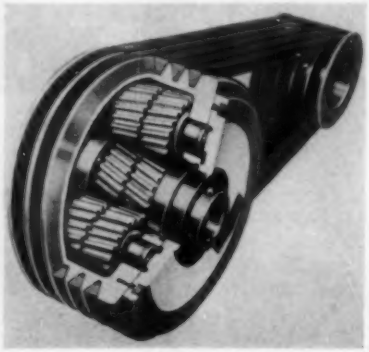
covery, is recommended by manufacturer for use in both fresh waters and in brines against sulfate reducing bacteria. It is also effective against slime bacteria. Dearcide 703, for recirculating cooling water systems, destroys sulfate reducing bacteria in combination with slimes or algae growths. Primarily for open recirculating cooling water systems, Dearcide 707 is said to provide broader algaecidal properties than previously available treatments, and to do away with heavy floc. Dearcide 717 is described as effective against slime-forming and odor-producing bacteria in air wash and open recirculating cooling water systems. It is also an algaecide. Dearborn Chemical Co.

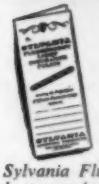
**For details, circle 54 on Post Card**

**Use the Reader Service Cards provided on pages 255-256 to ask for more information on any of these products.**

## ROTATING TRANSMISSION offers control flexibility

Roto-Mission is a shaft-mounted rotating transmission designed to provide a combination of control flexibility, high torque capacity, compact size. Manufacturer says it is a third smaller and provides up to six times the torque of other units, affords reduction ratios up to 270 to 1 exclusive of additional reduction through pulley drive from the drive motor, and affords a wide range of control options. Concentrically mounted on a machine's driven shaft, the transmission operates the machine at a reduced speed from that of the drive motor. Because it is contained within the outer surface, which is machined for V-belt drive from the





## TO GIVE YOU YOUR MONEY BACK!

The offer is still open! Every Sylvania fluorescent we sell is covered by the Sylvania Light Insurance Policy. Have you read it? It guarantees: *"If at any time a Sylvania Fluorescent Lamp fails in your opinion to provide better performance than any other brand fluorescent lamps, on the basis of uniformity of performance, uniformity of appearance, maintained brightness and life, it may be returned to the supplier for full refund of purchase price."*

**Sylvania Fluorescents up to 14% brighter.** Up to 14% more light than other brands from the first minute the fresh lamps are turned on. In *maintained* brightness you usually get as much light as 108 standard fluorescents for every 100 Sylvania lamps you install. And this is true hour after hour after hour after hour. You save on TCL (Total Cost of Lighting), which means cost of lamp plus power plus maintenance.

**Last longer, less maintenance.** Cost of the lamp itself represents only one tenth of the Total Cost of Light. The balance is power consumption and maintenance. Sylvania fluorescents not only burn brighter on the same amount of power, they last longer, require far less replacements.

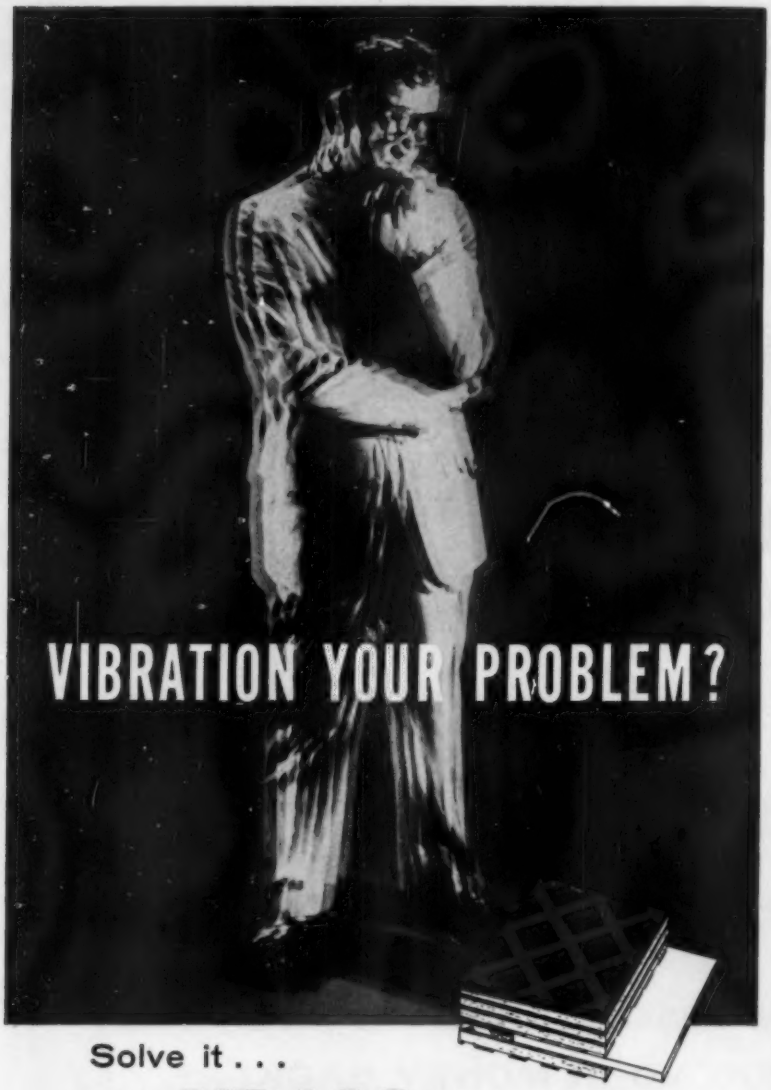
**Want information?** Want better light? Call your Sylvania representative. Or write us:

Sylvania Lighting Products, a Division of Sylvania Electric Products Inc., Dept. 59, 60 Boston Street, Salem, Mass. In Canada: Sylvania Electric (Canada) Ltd., P.O. Box 2190, Station "O," Montreal 9.

# SYLVANIA

*Subsidiary of* **GENERAL TELEPHONE & ELECTRONICS**

**For more facts circle 640 on Reply Card**




Solve it . . .

with **AIR-LOC** Mounting Pads

For isolating and dampening vibration, Air-Loc is the answer. In actual production tests, it successfully reduces vibration up to 85%. Air-Loc is easy to install in a matter of minutes. It can be quickly shimmed for leveling, gives permanent machine alignment . . . and is re-usable.

The scientific cross-grid embossing of Air-Loc machinery pads literally anchors your machines to the floor . . . without cement, without bolts.

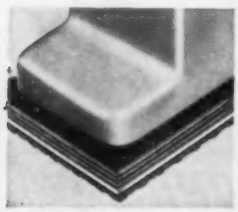
Air-Loc is made of three materials, and each plays its part in giving you the ultimate in easy, yet positive machine mounting:

**Cork** — absorbs vibrations, shock and noise. The cork used in Air-Loc is specially processed, under patents, to bring out its best physical properties.

**Sisal Fibre** — selected long-fibred sisal adds strength and stability.

**Vinyl** — completely surrounds the cork and sisal to give exceptional durability and permanent resistance to oils, alkalies and acids.

Write today for full information and sample.



Air-Loc® DIVISION

**Clark, Cutler, McDermott Co.**

115 WEST CENTRAL ST. • FRANKLIN, MASS.

For more facts circle 641 on Reply Card


# PLANT ENGINEERING EQUIPMENT

(Begins on page 200)

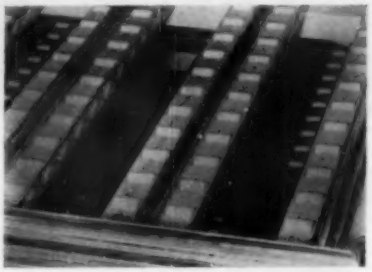
motor, the unit is extremely compact.

It is also said to provide high torque capacity at any reduction, minimum size for any specific torque value, options of torque capacity for each reduction ratio, high overload capacity, progressive overload capacity, reversibility, quiet operation, long life and ease of installation. Flexibility of operation is exhibited in: actuation (driving action can be engaged or disengaged through mechanical, electrical, pneumatic or hydraulic means); overload (load limiting or releasing, and overload alarm can be provided by various auxiliary devices); speed (dual-speed operation can be provided by various methods of clutching). The transmissions come in capacities from fractional through 60 hp, for torque ratings through 21,850 lb-ft. Airborne Accessories Corp.

**For details, circle 55 on Post Card**

## ROLLER CONVEYOR gravity feeds storage shelves

Rolla-Trak is a light duty roller conveyor for automatic, gravity feeding of industrial storage shelves. High density polyethylene rollers are set in self-lubricating Sharon Galvanite steel



channels to provide gravity flow. Applicable for heavy products which demand deeper runways, rollers are made to move up to 80 lb down long runways at low slope angles, eliminate jarring and toppling, and allow multiple stacking. Back-of-the-rack loading permits first-in, first-out inventory. North American Equipment Co.

**For details, circle 56 on Post Card**

## HIGH-TEMP COLLECTOR utilizes glass cloth bags

This glass cloth dust collector is designed to answer the need for a fabric arrester where greater than normal efficiencies are required and high temperatures are a factor. It is available in sizes from 1980 to 17,825 cfm in

# How Much Steam Should a Steam Trap Trap?

## . . . some answers to commonly asked questions about the primary job of a steam trap

You don't need a doctor's degree in thermodynamics to answer the question at the top of this page. Naturally, a steam trap should trap *all* the steam.

Unfortunately for you, the problem isn't quite that simple. After all, a shut off valve would trap all the steam . . . and condensate, and air, and carbon dioxide as well.

So we'd better amend the answer to the question this way: A steam trap should trap *all* the steam but *must* remove condensate, air and carbon dioxide as rapidly as they accumulate.

With this established, let's take a closer look at what's involved:

### A Steam Trap Should Trap All The Steam

If you've had experience with several different makes of traps, you already know that some trap steam better than others. The operating principle of the trap is what makes the difference. We like to talk about it because Armstrong traps are designed so that no steam can get to the orifice. The valve is always water sealed. Result: *More efficient steam utilization, lower fuel costs.*

### A Steam Trap Should Remove Condensate

All traps remove condensate—after a fashion. For maximum efficiency in the unit being drained, though, the trick is to get it out without waiting for it to cool and without leaking steam.

Armstrong's water sealed valve takes care of steam leakage. The inverted bucket operating principle opens the trap for water regardless of its temperature. This means you get the condensate out as quickly as it accumulates. Result: *Higher temperatures and better heat transfer in steam heated units.*

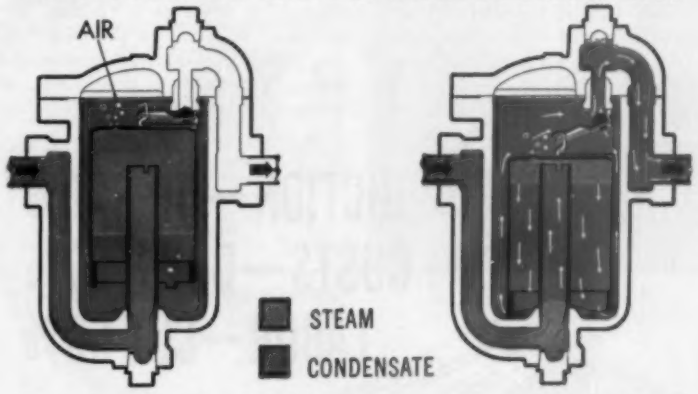
### A Steam Trap Should Remove Air and $CO_2$

Part and parcel of the condensate removal problem is removal of air as well as oxygen and carbon dioxide—two real troublemakers. Air tends to reduce operating temperatures and interfere with heat transfer. $CO_2$ goes into solution to form corrosive carbonic acid which, for example, can eat unit heater tubes. $O_2$ aggravates the situation. Believe it or not, but all traps don't properly remove air and $CO_2$.

By now, you've probably guessed that Armstrong traps *do* remove air and $CO_2$. Armstrong design (see illustration) provides continuous venting of air and $CO_2$. By opening suddenly, the Armstrong trap creates a momentary pressure drop to "pump" the air down to be vented. Result: *Higher temperatures, faster heat-up, better heat transfer and reduced corrosion.*

*Note: When required, specially sized air vents are furnished. For fast heat-up of low pressure on-and-off units, Armstrong provides open float and thermostatic air vent traps.*

**HERE'S THE STEAM TRAP DESIGN THAT GETS RID OF CONDENSATE AND AIR WITHOUT STEAM LOSS**




*Trap closed. Steam has floated inverted bucket; valve is held tightly closed by system pressure. Air entering trap passes through bucket vent and accumulates at top of trap.*

*Trap open. Condensate entering trap has caused bucket to lose buoyancy. Weight of bucket times leverage pulls valve open. Air is discharged along with condensate.*

### What's the Final Answer?

Summing it all up, you'll get the best service from steam heated units that are equipped with traps designed to trap *all* the steam and remove air and condensate as quickly as it accumulates. In our prejudiced viewpoint, this means Armstrong traps. More important are the several thousand users of Armstrong traps who have proved the point.

Before you make up your mind, though, consider the minimum maintenance requirements of Armstrong traps . . . and the convenient assistance your local Armstrong Representative provides. These are important plus values.

### Put Up or Shut Up

We're so confident that we "put up". Armstrong traps are unconditionally guaranteed to satisfy. So you can find out for yourself with practically no risk. If you're not completely satisfied with the way they do their job, you can get your money back.

* * *

The 44-page Armstrong Steam Trap book goes into greater detail on these and other Armstrong features. It also discusses trap selection, installation and maintenance. Ask your Armstrong Representative for a copy or write

**Armstrong Machine Works**
9125 Maple Street
Three Rivers, Michigan

**ARMSTRONG STEAM TRAPS**

613-ST

See our catalog in Sweet's Plant Engineering File

**For more facts circle 642 on Reply Card**

## PLANT ENGINEERING EQUIPMENT

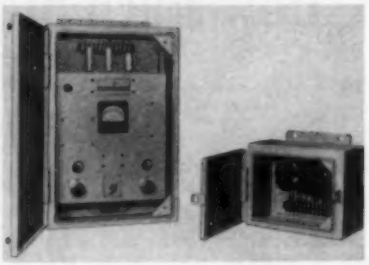
(Begins on page 200)

single units, for intermittent or continuous operation. Siliconized glass fabric bags are designed to withstand constant temperatures of 550 F. They are collapsed pneumatically to dislodge collected dust. Cylindrically designed collector uses interlocking zinc grip coated steel panels with 60-deg conical hopper. Walkways are provided at upper and lower service levels, and caged ladder to upper inspection platform. Bulletin 283 gives details. American Air Filter Co., Inc.

▲ For details, circle 57 on Post Card

### ELECTRONIC UNIT monitors a-c motor load

Designed to respond to actual power demands instead of current alone, TorqueTrol is said to detect motor load changes as little as a fraction of 1 per cent. It monitors the motor torque, which is directly proportional to power, manufacturer points out, and because TorqueTrol response is a function of power, it can detect load changes that current-sensitive load controls cannot. It is claimed to react quickly to load variations, to respond to underload or overload. Typical applications include protection of machine tools against damage due to misfeed etc; detecting excessive power on presses; controlling grinder feed rate. The relay-type output can be used to stop the motor, operate an alarm or signal system, count work cycles. The Clark Controller Co.

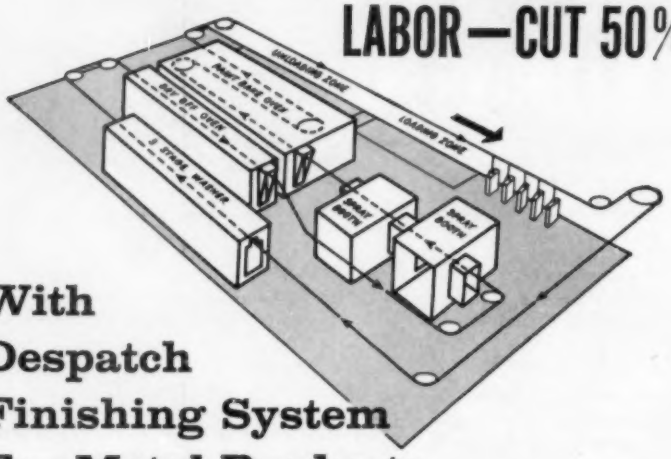


▲ For details, circle 58 on Post Card

### CONVERSION UNIT for electrostatic precipitators

This conversion unit comprising a silicon rectifier is especially designed for electrostatic precipitators now using mechanical types. The conversion unit costs about a third as much as a complete new power pack, and it utilizes existing equipment except for rectifier motor, disc, shoes, suppressor elements and pedestal. It ties in with present a-c connections, and also with the d-c switchgear which distributes the rectified power. Electrical efficiency is reportedly about 25 per cent greater than the mechanical type. Complete replacement takes 6 to 8 manhours; all parts of old and new rectifiers can be handled by one man, and without rigging. The new rectifier is made up of four independent units, and has a choke in the output line to protect rectifier from high voltage feedbacks. Each unit comprises two racks of silicone diodes immersed in an insulated container of dielectric fluid. This conversion rectifier can also be used to

PRODUCTION—UP 300%
COSTS—DOWN 67%
LABOR—CUT 50%



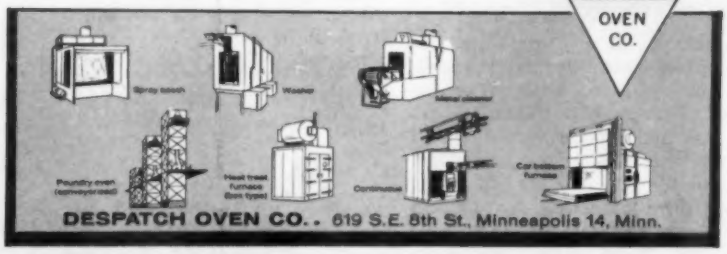

With Despatch Finishing System For Metal Products

The figures speak for themselves. Hoffman Engineering Corp., Anoka, Minn., reports that savings in production and labor costs alone paid for its complete new Despatch finishing system in only two years. And production was boosted 300% in the bargain.

The conveyorized system, designed and installed by Despatch engineers, not only produced these remarkable improvements but is capable of easy expansion in the future to match the company's growth.

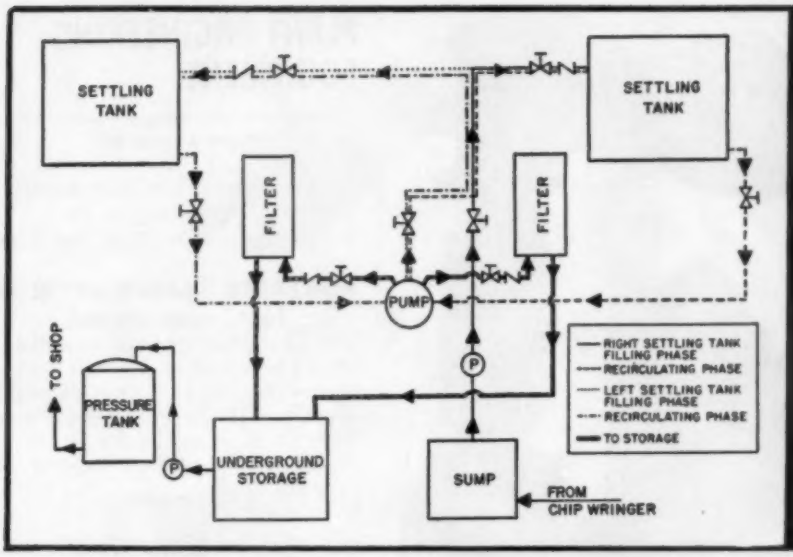
Despatch's years of experience and imaginative engineering have produced solid results for this Minnesota firm and thousands of others. You can put these qualities to work for you, too. Let us show you how . . . write today! for free bulletin 100CL.

DESPATCH OVEN CO.

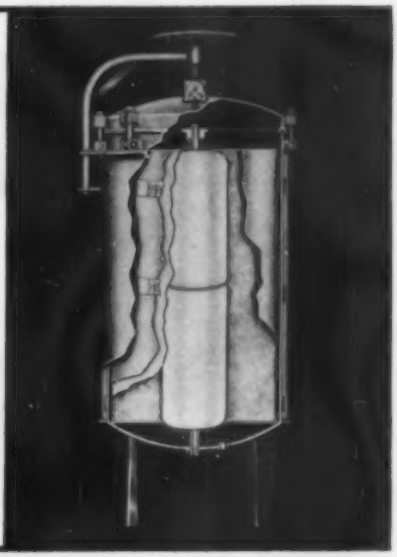



DESPATCH—INDUSTRY LEADERS FOR 58 YEARS

For more facts circle 643 on Reply Card




Schematic diagram shows arrangement of basic components in oil reclamation system.



CFC Honan-Crane Filter

# How Western Machine Company of Milwaukee, Wis. Keeps Cutting Oil Clean for 50 Machine Tools

CFC Honan-Crane Filters are at the heart of Western Machine's cutting oil reclamation system for 50 machine tools — including multiple and single spindle automatic screw machines, turret lathes, production lathes, and thread cutting machines. The constant use of *clean* oil affords better lubrication and cutting action, longer tool life, smoother finish on work, and decreased downtime.

Oil is removed by centrifugal force from literally tons of chips, and flows into settling tanks. It is pumped into sterilizing tanks where it is heated before being pumped into CFC Honan-Crane Filters, equipped with thermostatically controlled heaters, thermometers and pressure gauges.

Filter media is Cranite (fuller's earth) and Palconia (inert cellulose) which removes both soluble and insoluble micro-contaminants. Over 10,000 gallons of cutting oil passed through filter before media replacement was necessary.

CFC filtration equipment, including Honan-Crane, Delpark and Fulflo Filters, is engineered to your exact requirements for micro-filtration of all types of industrial fluids. Write for catalog or engineering assistance to Department PE.

CFC

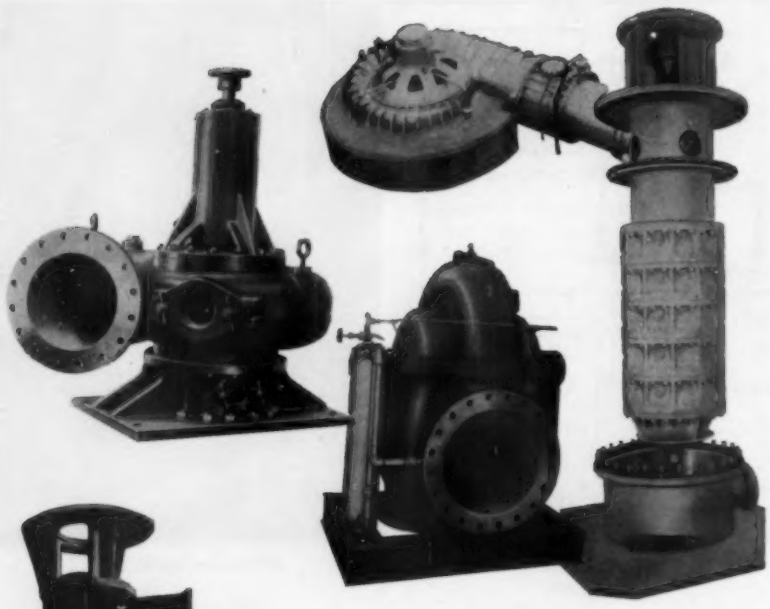
**COMMERCIAL FILTERS CORPORATION**

*Fulflo Honan-Crane Delpark Michiana*

MELROSE 76, MASSACHUSETTS

PLANTS IN MELROSE, MASSACHUSETTS AND LEBANON, INDIANA

For more facts circle 644 on Reply Card



## SPEAKING OF PUMPS!

Specifying or buying pumps is a big responsibility. You must be sure the pump you select will operate efficiently, economically and dependably "around-the-clock" or in emergencies.

C. H. Wheeler can help you! We make the type pump you need—centrifugal, mixed or axial flow, both horizontal and vertical—in a wide range of capacities and heads.

Also, we can assist you in designing your pump installation, whether it be for municipal or industrial water supply, sewage, drainage, irrigation, flood control, fire protection, heating, air conditioning, or steam power plant services.

We've been designing and manufacturing quality pumps for almost three quarters of a century, so you know when you specify or buy C. H. Wheeler pumps, you can depend on them. Consult your local representative or write for more information.

**C. H. WHEELER MFG. CO.**

19th and Lehigh Avenue, Philadelphia 32, Pa.

Centrifugal, Axial and Mixed Flow Pumps • Steam Condensers • Steam Jet Vacuum Equipment • Marine Auxiliary Machinery • Nuclear Components

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You'll find two postage-free Reader Service Cards on pages 255-256. Use them for ordering equipment details—just circle item numbers of equipment you would like to know more about. You may also use the cards for requesting advertised catalogs.

# PLANT ENGINEERING EQUIPMENT

(Begins on page 200)

replace electronic tube type rectifiers. The Buell Engineering Co., Inc.

**For details, circle 59 on Post Card**

## PORTABLE SANDBLASTER is fast, economical

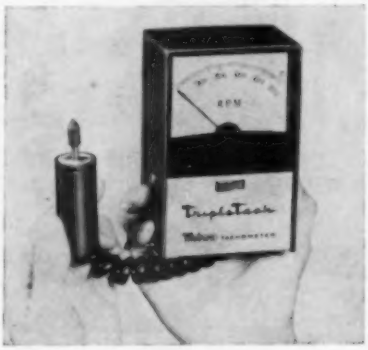
The Hand-Blast Portable Sandblaster is said to require no more air than a production spray gun. Over-all height of the unit is 23 in.; it has a tank diameter of 7 in. It weighs 23 lb empty, has an abrasive capacity of

30 lb sand. Air supply of the unit is consumed at the rate of about 8 cfm, using the furnished 3/32-in. nozzle and air supply from a 2-hp compressor. A 5/32-in. nozzle, also furnished, consumes about 20 cfm, requiring an air supply from a 5-hp compressor. Tested at 300 psi, the Handi-Blast Portable Sandblaster operates with abrasives between 20- and 100-lb mesh. It costs around $100. Hamill Mfg. Co., Inc.

**For details, circle 60 on Post Card**

## HAND TACHOMETER is small in size, low in price

Features offered by the Tripletach include small size, light weight, rugged construction and a price tag under $100. The metal case contains sealed



# Do you need this to open the doors to your plant?

**IF THE DOORS TO YOUR PLANT ARE HARD TO OPEN . . . IF THEY SLAM SHUT LIKE STEEL TRAPS . . . YOU NEED MAKE-UP AIR.**

Slamming doors are just one symptom of a serious problem that can raise havoc with your plant and process efficiency and increase worker absenteeism. Here's why. Exhaust fans take out air along with the dust and fumes, creating a vacuum. Nature abhors a vacuum, so your plant attempts to make up the exhausted air any way it can . . . through doors, around windows and through cracks in the walls. It never quite succeeds so a partial vacuum remains. What does all this mean to you? Combustion processes are starved for air. Your exhaust fans don't work efficiently. Workers are too cold near drafty outside walls and too hot in the center of the plant. These things mean costly, inefficient operation and high absenteeism. Want a free evaluation of your plant's present ventilation system? Call in Westinghouse application engineers, experts on the subject . . . or write for our booklet on **balanced** ventilation. Dept. **KE04**, Sturtevant Division, Hyde Park 36, Mass. You can be sure . . . if it's Westinghouse.

**Westinghouse**

J-80704

For more facts circle 646 on Reply Card

## PLANT ENGINEERING EQUIPMENT

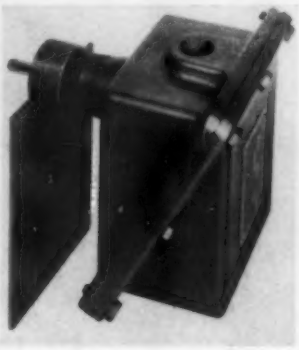
(Begins on page 200)

meter movement, printed circuitry, speed pick-up and its retractible cord, and provides storage space for shaft tips and other accessories. Series 27 Tripletach is available in three types; Type A measures from 200 to 10,000 rpm; Type B, from 100 to 5,000 rpm; and Type C, from 20 to 1000 rpm. Metron Instrument Co.

▲ For details, circle 61 on Post Card

### ROTATION DETECTOR checks on variations in speed

Flo-Motion Shaft Rotation Detector is described as an electronic watchdog that automatically stops rotating equipment whenever excessive speed variation occurs. It comes in two models, M300 and M301, the former permitting a relatively wide variation in shaft speeds before signalling stoppage or slowdown. Model M301 is for use where shaft speed must be closely watched. Range of speed detection may be ordered to suit application. The units can be used on processing equipment, and are reported particularly useful in enclosed, underground and remote machinery. Features, in addition to detection of speed variations as small as 1 rpm, include a warning



signal in event of component failure or power interruption. The instrument can be mounted in any position, and the input shaft can turn in either direction. Flo-Tronics, Inc.

▲ For details, circle 62 on Post Card

### MACHINERY MOUNT isolates horizontal motion

Series RM is a horizontal force mount offered for isolation of shock and vibration produced by horizontal compressors and other machines whose operation develops predominantly horizontal forces. Each mount is designed to handle up to 4000 lb of static load; one is used under each machine foot or support point and all are positioned for cushioning in the direction of horizontal forces. The equipment rests on

a top plate that rides on a set of internal rollers and is laterally restrained by end-positioned Neoprene springs, available in various stiffnesses to permit selection of spring-rate suited to forces and frequencies involved. The Series RM is 10 5/16 in. by 8 in. overall, and 1⅜ in. high; it is furnished with attachment bolt and locknut. Barry Wright Corp.

▲ For details, circle 63 on Post Card


P&S TURNLOK

Built to Take It

P&S TURNLOK wiring devices are designed to give trouble-free service no matter how tough the going gets. TURN-LOK devices are available in 10 and 20 Amperes, 2-, 3-, and 4-wire types: receptacles, connectors and caps.

All P&S TURNLOK devices have extra large head binding screws and ample wireways for quick, easy wiring. Armored sections are anchored securely. Cap blades are positioned accurately. Contacts are anchored securely. Fastening screws in connectors are secured in body . . . cannot fall out in wiring. Ratings are plainly visible.

*For information about P&S TURN-LOK Line, write Dept. PE-116.*

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For more facts circle 647 on Reply Card

# HALLOWELL

## STOOLS AND CHAIRS

*give you everything you want!*

Model 200
Steel or Presd-wood covered steel seat.

Model 206
Same as 200, with clamp type steel backrest.

Model 220
Stool. 2-inch swivel ball bearing casters.

Model 250
Shaped plywood seat, hinged backrest.

Model 260
Seat adjusts for tilt, height. Hinged backrest.

Model 232 K.D.
Adjustable stools in package of 6.

Model 241
Adjustable revolving seat, tubular legs.

Model 245
Same as 241, with backrest.

Model 276
Adjustable revolving contour seat.

Everyone in the shop sits more comfortably, more efficiently on Hallowell chairs and stools. And what a variety! Models with tubular or channel legs—polished steel glides or with casters. Round or contoured seats—revolving or stationary—fixed or adjustable in height. Look into the Hallowell line today. It will pay off in better work from happier people.

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*where reliability replaces probability*

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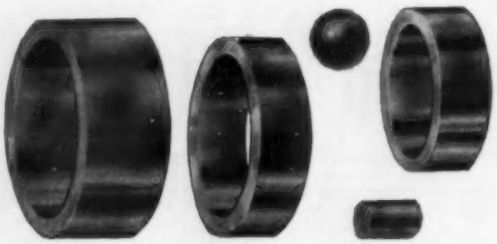
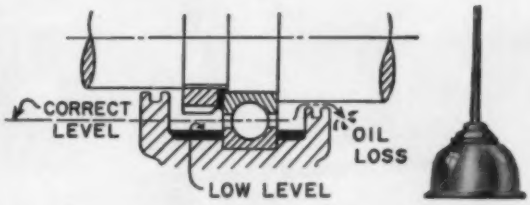
## *DISTRIBUTOR DAN*, the SKF bearing man, tells

# WHY BEARINGS BECOME OVERHEATED

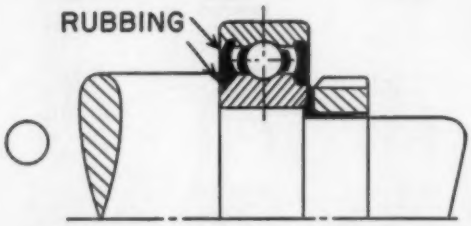
## and how to correct the conditions that cause excessive heat.



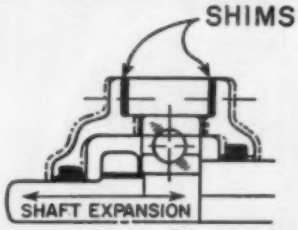
**LOOK FOR THIS SYMPTOM.** Discoloration of a bearing's rings, balls or rollers is a sure sign of overheating. The color is usually a gun-metal blue or bluish black.



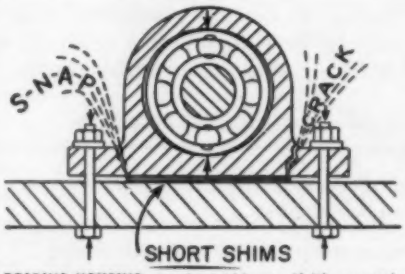

**IMPROPER LUBRICATION OR LUBRICANT** accounts for most cases of overheating. In pillow blocks, if oil is specified, fill only to the center of the lowest ball or roller in the bearing. If it's grease, the lower half of the pillow block should be filled. Therefore, be sure you're using the right lubricant—**in the proper quantity.**




**RUBBING** is a frequent culprit. Check the running clearance of the bearing seal. If it rubs against the shaft shoulder, remachine the shoulder, to allow proper clearance. Bent lockwasher prongs are sometimes to blame. Straighten them or replace the washer.




**EXTERNAL HEAT,** conducted through the shaft, can make an inner ring expand excessively. It's usually the result of using a bearing with inadequate internal clearance. Make sure the replacement bearing is exactly the same as the original bearing. Should the markings be indistinct, consult an **Authorized SKF Distributor.**




**THE BEARING HOUSING** may be to blame—if it's warped or if the bore is distorted and out-of-round. Check to see whether the bore is pinching the bearing and relieve by scraping the bore. Make sure, too, that the pedestal surface is flat and that any shims cover the entire base area.

**Baffled by a bearing problem? Whether it's selection, mounting, or maintenance—consult your Authorized SKF Distributor. He's staffed to help you keep them running smoothly and he stocks all the bearing types and sizes you need.**

*Spherical, Cylindrical, Ball, "Tyson" Tapered and REED Miniature Bearings*

EVERY TYPE—EVERY USE

**SKF®**

SKF INDUSTRIES, INC., PHILADELPHIA 32, PA.

*REG. U. S. PAT. OFF.

**For more facts circle 649 on Reply Card**

## New Plant Construction

(Continued from page 188)

here for the manufacture of electronic components. Construction will begin at once with completion scheduled for the summer of 1961. New facility will have a floor area of 120,000 sq ft. Initial work at the plant will deal with development of electrical capacitors for use in electronic circuits. Cost of plant and equipment will be approximately $1.5 million.

**Cleveland, O.**—General Electric Co., River Rd., Schnectady, N. Y., has awarded a contract to the Brown Construction Co., 3334 Prospect Ave., Cleveland 15, O., for the construction of an administration office and major appliance warehouse in this city. New facility to cost about $1.2 million will have a floor area of approximately 125,000 sq ft. Work will start as soon as preliminary engineering work is completed and plant is scheduled to be in operation late in 1961.

**Marcus Hook, Pa.**—Sun Olin Chemical Company, plans to construct an ethylene and ethylene oxide plant adjacent to Sun Oil Co.'s refinery here. The jointly owned affiliate of Sun Oil Co., and Olin Mathieson Chemical Corp., has awarded a construction contract in the amount of $20 million to the Lummus Company, of New York, a subsidiary of Combustion Engineering, Inc. Construction will get under way soon with the plant scheduled for operation in the fourth quarter of next year. Plant is designed to produce 225 million pounds of ethylene and 55 million pounds of ethylene oxide annually.

**Charleston, Tenn.**—Olin Mathieson Chemical Corp., Mathieson Building, Baltimore, Md., plans to construct a $13-million plant to be located on a 600-acre site here, for the production of chlorine and caustic soda. Work will get under way at once on the new plant which will have a capacity of 180 tons per day, and it is expected to be in operation by the fourth quarter of 1961.

**Texas City, Texas**—Plymouth Oil Co., Benedum-Trees Building, Pittsburgh, Pa., plans to construct a Hydeal unit capable of producing 15 million gallons of benzene annually at company's refinery here. The addition of benzene to company's product line is the first step in a long range plan of diversification and modernization here. Work will begin soon on the new unit which is scheduled for completion by May of 1961.

**Ogden, Utah**—Boeing Airplane Co., 7755 E. Marginal Way, Seattle, Wash., plans to construct a new Minuteman missile assembly plant at Hill Air Force Base located here. Contract, estimated at $10 million, was awarded to Diversified Builders, Inc., and Johnson Construction Co., of Paramount, Calif., a joint venture, and calls for construction of 10 buildings and rehabilitation of 65 existing buildings on the 800-acre site. Work will begin at once and is scheduled to be ready in 1961.

**Vernal, Utah**—Stauffer Chemical Co., 382 Madison Avenue, New York, 17, N. Y., plans to construct a new fertilizer plant in eastern Utah. The facility, to be located 125 miles east of Salt Lake City, will utilize large deposits of phosphate ores in the area.

**Kohler, Wis.**—Kohler Company, 44 High St., this city, has authorized plans for a pottery plant addition

(Continued on page 248)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TOP QUALITY
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in hydraulic power devices

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838 CENTER AVENUE, LOGANSPORT, INDIANA

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A 32-page manual on fluid power circuits (fifth edition) completely revised to present current engineering trends.

MEMBERS: Nat. Mach. Tool Builders' Assn./ Nat. Fluid Power Assn.

ILLUSTRATED—LOGAN MODEL 6021 HYDRAULIC POWER UNIT

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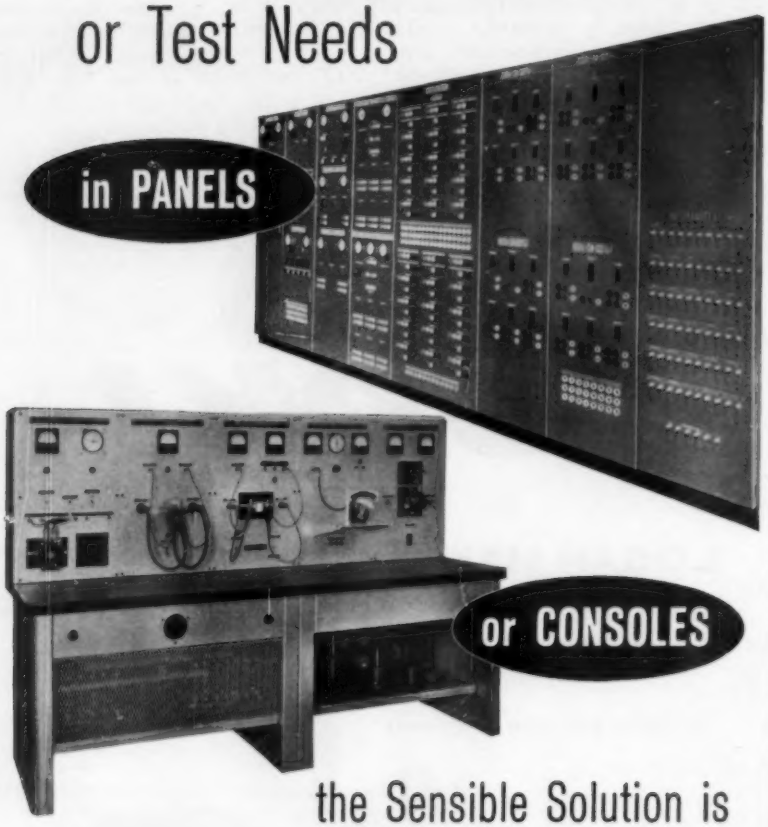


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Realistic plant engineers recognize that, for design and construction of specialized equipment like this, it's good sense to rely on a qualified outside source.

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Standard engineers will be glad to consult with you and offer recommendations. And whether the solution is a small power pack or a million dollar, multi-building installation, Standard has the skills, experience and facilities to design and produce—completely—the equipment to meet your requirements.

STANDARD TRADEMARK

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THE STANDARD ELECTRIC TIME CO.

89 LOGAN STREET • SPRINGFIELD, MASSACHUSETTS

For more facts circle 651 on Reply Card

## New Plant Construction

(Continued from page 247)

at company's headquarters here. Concrete and steel frame structure, one-story high will be 180 ft wide and 600 ft long. Work on the new facility will begin at once for completion by late 1961. Permanent Construction Co., 2200 N. Third St., Milwaukee, Wis., was awarded the $1 million construction contract.

**Wisconsin Rapids, Wis.**—Consolidated Water Power & Paper Co. plans to expand its Wisconsin River Division at Whiting, Wis. Company will install a new paper machine with a 25,000 ton annual capacity of enamel printing papers. Work to cost about $8 million will get under way at once and is scheduled for completion by September 1961. Plans include corresponding increases in auxiliary facilities necessary to the startup of the new machine. These would include enlargement of the boiler house, ground-wood pulp and bleach departments, coating plant, finishing facilities and stores.

## Plant Engineering Schedules

(Continued from page 115)

jobs on the basis of engineering capabilities required. Whenever practical, in an effort to increase versatility, engineers are assigned work that is outside their specialized areas.

**Equipment.** The time-tested Gantt principle is utilized for graphic visual control, and a commercially available board holds snap-in cards for job data and arrows for continuations. Schedule adjustments on this board, which is maintained in a central location in the department, can be made quickly by interchanging cards. Each engineer can easily check his schedule position, as well as the schedule position of the other engineers with whom he will be working.

**General.** The subject of engineering scheduling is conspicuously absent from textbooks on plant engineering methods and procedures. Its development and use at Lockheed Aircraft Corporation's Georgia Division has increased the efficiency of the overall operation; and through the rigid control afforded by the system, facilities and services are provided with a minimum of lost time. **End**

## ONLY DRACCO CAN OFFER

# sonic cleaning

(patented)

### *the most modern and efficient method for removing dust from cloth-bag dust collectors*

Dracco dust collectors now utilize one of industry's most exciting new techniques — *sonics* — to realize greatly improved filter bag cleaning action. This development is so significant that you should not specify or buy another dust control unit until you get the full story on sonic cleaning.

Sonic cleaning — patented and available exclusively from Dracco — provides three operating advantages: *lower back pressure* through effective dust removal; *longer bag life* since bags are not flexed, creased or shaken; *lower maintenance* through elimination of moving parts within the collector.

Cleaning by low-frequency sound waves has been conclusively proved in full-scale field operations on both Glass-Bag Filters and on conventional baghouses using cotton and synthetic bags.

Sonic cleaning is recommended for cement mill applications (kilns, grinding, classifying, materials handling), electric and open hearth steel furnaces, metallurgical furnaces, rock dryers, calciners, fusing furnaces, chemical processes and related applications. You can use it wherever mechanical shaking is undesirable or unsuitable and eliminate the shakers.

You can get further information on Dracco sonic cleaning and expert consultation on your dust control requirements from: Dracco Division of Fuller Co., Harvard Avenue & East 116th Street, Cleveland 5, Ohio.

**Proved in service** — Dracco Glass-Bag Filter equipped with sonic generators cleans cement kiln gases. Sound waves dislodge collected dust without wear or fracture of cloth.

**DRACCO** *airstream* conveyors
dust control equipment

FULLER COMPANY GENERAL OFFICES

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# "When we put in the Payroll Savings Plan...

## "It fitted into our operation perfectly...

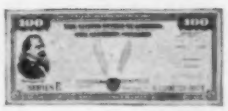
"I had an idea it might be a bit complicated to install the Payroll Savings Plan. Seeing all our people, explaining how it operates, pointing out its advantages. But the way it worked out it was simplicity itself.

"All we did was contact our State Savings Bonds Director. He outlined the campaign for us, working through the bond officer we appointed. A short, company-wide person-to-person canvass was set up—and the results were absolutely amazing. Some of our people told us later that since they found out how convenient it is to save *regularly* through the Payroll plan they have actually increased other investments, too!"

When your company has a flourishing Payroll Savings Plan for U.S. Savings Bonds, participating employees have the added satisfaction of helping to keep America strong.

For prompt, friendly help in setting up a Payroll Savings Plan in your organization, contact your State Savings Bonds Director. Or write Savings Bonds Division, U.S. Treasury Department, Washington, D.C.

ALL U.S. SAVINGS BONDS—OLD OR NEW—EARN ½% MORE THAN BEFORE



PLANT ENGINEERING

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## "On Tap" Plant Services

(Continued from page 181)

from the main gas line at the Trafford plant and 140 psig oxygen gas is piped throughout the fabrication area from a liquid oxygen storage tank.

The use of natural gas and oxygen piped under the floor to work station outlets eliminates the necessity of handling about 400 hydrogen and oxygen bottles each month and makes it unnecessary to have long hose lines stretched across the floor.

A large part of the welding is done with automatic welding machines which require an inert gas atmosphere. Argon gas is distributed to 38 welding stations through copper lines from bulk liquid storage tanks.

The welding on some materials such as aluminum requires 100 per cent pure argon while on steel a better weld is obtained with 98 per cent argon and 2 per cent oxygen and certain steels may require up to 5 per cent oxygen with the argon.

This mixed gas is obtained by mixing the argon and oxygen together in a proportioner which takes the gases from the main distributing pipelines and mixes the gases accurately to the required proportions. The mixed gas is then distributed to the desired areas.

The mixing of these gases eliminates the need to stock three different mixes of argon gas in bottles and costs about 25 per cent less when bought in large liquid gas containers.

Another supply system which saves handling time is in the painting operation. Six colors of paint are supplied from the paint vault along with thinner. The paint and thinner are pumped through a circulating system made up of 5000 ft of ⅞-in. O.D. thin walled steel tubing.

The paint is distributed to three large spray booths and a conveyorized painting and drying system. This paint distribution system saves the handling of paint drums and enables the painter to change quickly from one color to another to meet the requirements of the shop.

Thorough planning and cooperation between the layout engineers, manufacturing supervisors and the plant engineering department has resulted in the installation of a network of underground piping that has almost eliminated the need for handling gas bottles and paint drums.

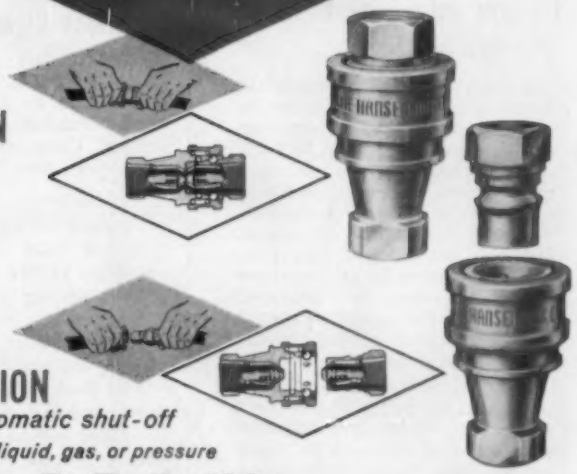
Also, the outlets in each working area have made it unnecessary to have long lengths of portable hose lines stretched across the work areas or aisles. The piping system has made an important contribution in building a new and efficient manufacturing plant for power circuit breakers. **End**

"Us idiots gotta stick together, huh boss!"


HANSEN

SERIES HK* QUICK-CONNECTIVE

TWO-WAY SHUT-OFF COUPLINGS



QUICK CONNECTION

*with instant automatic flow*

QUICK DISCONNECTION

*with instant automatic shut-off*

*...prevents loss of liquid, gas, or pressure*

To connect a Hansen Two-Way Shut-Off Coupling, you merely pull back the sleeve and push the Plug into the Socket. To disconnect, just pull back the sleeve. No tools required. When Coupling is disconnected, similar valves in Socket and Plug shut off both ends of line—practically eliminating spilling of liquid or escape of gas at instant of disconnection.

**Available in brass or steel, with female pipe thread connections from ⅛" to 1½" inclusive.**

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Here is an always ready reference when you want information on couplings in a hurry. Lists complete range of sizes and types of Hansen One-Way Shut-Off, Two-Way Shut-Off, and Straight-Through Couplings—including Special Service Couplings for LP-Gas, Steam, Oxygen, Acetylene, etc.

SINCE 1915 — QUICK-CONNECTIVE FLUID LINE COUPLINGS

THE HANSEN MANUFACTURING COMPANY

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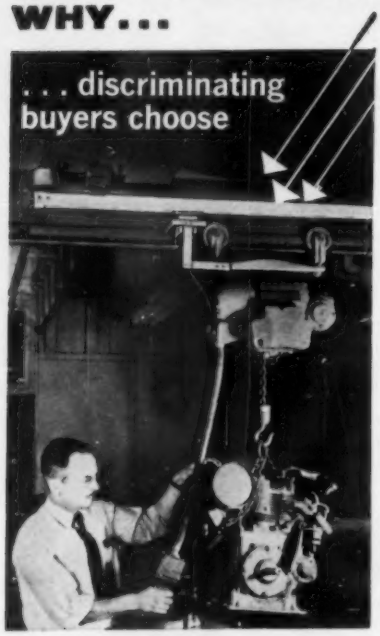


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# NEW BOOKS

## for the plant engineer

### Plastic Welding

**MAKING BETTER PLASTIC WELDS. Size 9 by 6 in.; 54 pp; illustrated; paper bound. Available from Laramy Products Co., Beechwood St. at Route 3A, Cohasset, Mass. Price $1.00.**

THIS BOOKLET in which theory and history have been minimized is an aid on the welding of structural plastics. It includes successful procedures, many "tricks of the trade" and over 100 illustrations.

Among the subjects treated in the pamphlet are the following: plastic welding equipment; tacking; semi-automatic speed welding; inspection, testing and evaluating welds; and thermoplastics as lining materials.

An illustrated chart gives reasons for various welding troubles and corrective advice for each.

### Conference Organization

**ORGANIZING THE TECHNICAL CONFERENCE by Herbert S. Kindler. Size 9 by 6 in.; 139 pp; cloth bound. Published by Reinhold Publishing Corporation, Dept. J., 430 Park Ave., New York 22, N. Y. Price $6.00.**

CONFERENCE techniques described in this book have been put to test successfully. In the book are details on initial planning, program development, and on organizing auxiliary and supporting activities such as clinics, lecture series, and banquets.

The book includes information on public relations and promotion and on conference documentation and evaluation. Specific material on the actual conduct of the conference by the chairman and conferers is also presented.

### Centrifugal Pumps

**USING CENTRIFUGAL PUMPS by E. Allen. Size 8¾ by 5¾ in.; 246 pp including index. Available from Oxford University Press, 417 Fifth Ave., New York 16, N. Y. Price $4.80.**

CENTRIFUGAL PUMPS, the workhorses of industry, get the practical treatment in this book which was printed in Great Britain. In the opening chapter the author discusses the principal components of pumps having: 1. a single inlet and single stage; 2. a horizontally split casing; 3. two or more stages. He also brings out features that these three types have in common.

Pump characteristics are examined in chapter two. A test setup for the gathering of data for establishing characteristic curves is covered briefly; this is coupled with information on the preparation of curves resulting from observations.

Among the principal topics of the remaining 20 chapters are the following: selecting a pump for emergency use; taking advantage of a positive suction head; series pumping; using fixed pumping installations for emergency fire-fighting duties; vertical pumps; automatic control; and using pressure and vacuum gages with centrifugal pumps.

### On Lighting

**LIGHTING HANDBOOK. Size 7½ by 5⅜ in.; 248 pp; illustrated; loose-leaves, wire-held. Published by Westinghouse Lamp Division, Westinghouse Electric Corporation, Bloomfield, New Jersey. Price $3.00.**

THIS IS a newly revised edition of the familiar handbook which is packed with information on lighting. Beginning with the fundamental explorations of the human eye and vision the coverage continues with a section on the characteristics and measurement of light. It then goes into a discussion of light sources encompassing filament, mercury and fluorescent lamps. This is followed by an introduction to lighting design.

Other chapters deal with: interior wiring for lighting; lighting for school and office, store, industrial, architectural, roadway, sign applications; floodlighting design; germicidal lamps and sun lamps; and the cost of lighting.

### On Chemistry and Physics

**HANDBOOK OF CHEMISTRY AND PHYSICS. Size 7⅛ by 5¼ approx; 3481 pp including index; illustrated; cloth bound. Published by the Chemical Rubber Publishing Co., 2310 Superior Ave., N.E., Cleveland 14, Ohio. Price $12.00.**

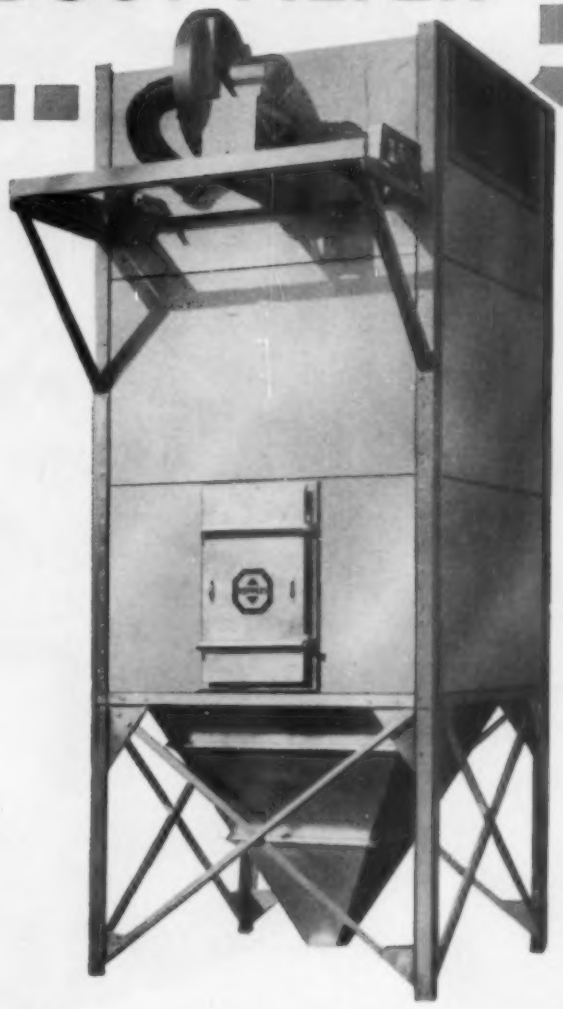
THIS BOOK is a one-source reference covering mathematics, physics and chemistry; it is an up-dated, 42nd edition of the publication.

Over 200 collaborators have contributed to the material in this book which has the areas of interest classified under five handy indexes.

The first three sections deal individually with: mathematical tables, properties and physical constants, and general chemical tables. The fourth section offers information on the principal subjects of: heat and hygrometry, sound, electricity and magnetism, and light. The final division pertains to: quantities and units.

Reverse-air jet filtering comes of age with the

# NEW KOPPERS MODEL K AEROTURN® DUST FILTER



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# BULLETINS

(Begins on page 21)

**Economical Bulk Handling**—Bulletin 532, 6 pp, tells how plastic users save costs and get better productivity by modernizing methods for handling pelletized plastics. Shows examples of combination and suction-type pneumatic conveyor systems. Describes some installations ranging from an automatically controlled 11-system one to a smaller, yet versatile system used by a medium sized plant. Dracco Div., Fuller Co.

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**Air Conveying System** — Efficiency gains possible with company's low density or high density conveying systems are covered in 16-pp Bulletin M-260. Typical arrangements are shown as well as several installation photos. The Day Co.

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**Conveyors for Small Parts**—This 8-pp bulletin describes small parts handling conveyors featuring cleated belt design for general, light and heavy duty. Specifications and photos of typical installations are included. The Rapids-Standard Co., Inc.

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**Stacker Crane**—Applications of stacker cranes in the warehousing of steel bar stock, dies, rolls of cellophane and aluminum foil, drums and pallets are described in 12-pp Bulletin SB-1. Advantages are detailed. The American MonoRail Co.

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**Car Shaker**—Described in 6-pp Folder 2745 is a one-man operated railroad car shaker which incorporates a low-frequency vibration shaker mechanism for economical unloading of hopper bottom cars. Applications are pictured. Link-Belt Co.

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## DRAFTING EQUIPMENT

**Drafting Pencils**—A wide variety of pencils and other items designed for drafting and reproduction work are featured in this 24-pp catalog. Includes pencils for work on drafting film, for color coding on tracings, non-reproducing pencils for making temporary work notes on drawings, others. J. S. Staedtler, Inc.

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**Washable Tracings** — Described in this bulletin is a process of restoring the printability of original tracings simply by washing them with soap and water. Included is a sample of Herculean drafting film and a pencil which puts down a waterproof plastic line. Keuffel & Esser Co.

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## INSTRUMENTS, CONTROLS

**Instruments, Controls** — Pressure gages, thermometers and control instruments are described in Bulletin 6-pp 3020. Photos illustrate each item, with information on dimensions, accuracies, construction features and uses. U. S. Gauge Div., American Machine and Metals, Inc.

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**Liquid Level Transmitter**—Pressure and liquid level transmitter operating on the force-balance principle is featured in Bulletin P-36-1. Operation and design details are illustrated. Conoflow Corp.

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**Flow Meters**—Presented in Catalog C295-1 and Instrument Data Sheet 10.3-9 is detailed information on flow meters using vortex-velocity principle for measuring liquids and gases. Engineering data and diagrams included. Minneapolis-Honeywell Regulator Co.

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**Temperature Regulator** — Eight-pp Catalog J180-1 contains detailed information on sliding gate and plate temperature regulators designed for use on steam, water, air, oil, gas or chemicals. Includes sizing charts, flow curve, specifications and engineering data. OPW-Jordan Corp.

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**Dynamic Storage Computer**—Mathematical applications of the dynamic storage analog computer are covered in this 16-pp report. Covers dynamic memory, sequential calculations, the definite integral, multiple integration, continuous memory, etc. Computer Systems, Inc.

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**Servo System** — Instruction Manual 60-77, 12 pp, describes an electro hydraulic building block velocity servo system. It is intended as an aid in setting up and trimming the servo system, with step-by-step procedure and wiring diagrams. Vickers Inc., Div., Sperry Rand Corp.

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**Regulators, Manifolds** — Industrial gas regulators and portable manifolds are illustrated and described in 16-pp Form 55-085. Includes specifications and cross-sectional diagrams showing details of design. Linde Co., Div. Union Carbide Corp.

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**Alarm Rotameters**—Featured in Bulletin 18A are magnetic and electronic instruments for accurately measuring fluid rates of flow and warning of abnormal flow rates. Covers application, construction and operation, and includes dimensions, capacities. Schutte and Koerting Co.

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**Indicators, Control Stations**—Specification FS-301-9 describes new Electrik Tel-O-Set indicators and indicating control stations which continuously indicate and record standard 4-20 ma d-c output of suitable transmitter or transducer. Controller specifications, dimensions and features included. Minneapolis-Honeywell Regulator Co.

For a copy, circle 161 on Post Card

**Precision Air Regulators**—Operation and design details on precision air regulators, relays and volume boosters are presented in this 26-pp bulletin. Performance curve, schematic diagrams and detailed specifications are included, as well as wheel-type selector for easy reference. Stratos Industrial Products Branch, Div., Fairchild Engine & Airplane Corp.

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## PROCESS EQUIPMENT

**Tank Mixers**—Top entering Lightnin mixers for tanks are described in two new product folders. Bulletin B-522 describes the REC closed tank unit, while Bulletin B-523 covers the REQ open tank line. Mixers have a solid drive shaft coupled directly to the mixer shaft. Cutaway illustrations show design features of both models. Advantages are discussed. Mixing Equipment Co., Inc.

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**Process Equipment** — Described in 12-pp Bulletin G-3D is a line of equipment for the process industries. Operating principles are explained, and photos and drawings of typical installations included. Covers pneumatic conveyors, rotary compressors and vacuum pumps, horizontal grate coolers, suspension type preheaters, draft fans, others. Fuller Co.

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## TOOLS, WELDING AND MACHINE SHOP EQUIPMENT

**Machine Tools** — Light-heavyweight machine tools and accessories are illustrated and described in this 52-pp catalog. Covers drill presses, grinders, cutoff machines, band saws and belt and disc surfaces. Detailed specifications, dimensional data and drawings and illustrations are included. Walker-Turner Div., Rockwell Mfg. Co.

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**Safety Tools**—Spark-resistant tools designed to safeguard against fire and explosion are illustrated and described in Bulletin ST-5. Among tools described are wire brushes, hammers, scrapers, pliers, shovels, wrenches, etc. Ampco Metal, Inc.

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Postage-free Cards for ordering bulletins are on the facing page. Be sure to include your name, job title, and company, even if you want bulletins mailed to your home address.

**Turret Lathes**—Automatic chucking turret lathes which offer pre-selection of feeds and machine functions are featured in 22-pp Bulletin 1179-B. Advantages are detailed, specifications and diagrams of floor plans included. Gisholt Machine Co.

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**Improved Cutting Tool** — Bulletin 6006, 16 pp, provides detailed information on improved cutting techniques, new applications, performance charts, new cutting powders and new accessories for the Airbrasive unit for cutting hard, brittle materials. Examples of uses are shown, and features of both single- and

# BULLETINS

(Begins on page 21)

twin-jet models are described. A section on cutting speeds outlines factors which control removal of material. S. S. White Industrial Div.
▲ For a copy, circle 169 on Post Card

**Drill Jig Bushings**—Simplified selection and pricing data on drill jig bushings is presented in this 16-pp bulletin. A quantity discount schedule and table of decimal equivalents of standard drill sizes included. Acme Industrial Co.
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**Fusion Welding Equipment**—Developments in highly precise, fully automatic fusion welding equipment are covered in this 28-pp publication. Various types of precision fusion welding equipment systems are illustrated. Sciaky Bros., Inc.
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**Tips on Welding**—This 56-pp welding, brazing and soldering alloy and flux catalog and instruction manual, covers physical properties, major uses, detailed application instructions and latest techniques for welding, brazing, soldering, cutting and hardfacing. Charts and tables summarize alloy selection and properties. All-State Welding Alloys Co., Inc.
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**Flame Hardening Equipment** — Twelve-pp Form ADC-704A discusses the various problems of oxyacetylene flame hardening and shows how these problems can be solved with flame hardening equipment. Describes torches, tips, extensions, mixers and valve blocks. Air Reduction Sales Co., Inc., Div. Air Reduction Co., Inc.
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## CONSTRUCTION

**Hollow Partitions**—Latest methods of using hollow partitions with channel studs are covered in Technical Bulletin 15. Gives details, specifications and limitations of hollow partitions and includes dimensional diagrams illustrating details. Metal Lath Manufacturers Association.
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**Metal Framing Construction**—Catalog 710 is a 36-pp handbook giving application and installation information, specifications and methods of attaching to structures using Unistrut metal framing. Typical illustrations show such applications as support of pipe, conduit and cable, rigid frame construction, fluorescent fixture supports, raceways, bus bar supports, and substation structures. Unistrut Products Co.
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**Grating and Treads**—Characteristics of steel industrial grating and company's facilities for its manufacture and fabrication are described in 12-pp Bulletin 1112. Design, panel widths and load tables are detailed, as are typical clearances and various types of fasteners. Dravo Corp.
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**Sealing, Caulking Compound** — Advantages of an all-purpose sealing and caulking compound for a variety of industrial and electrical applications are detailed in Bulletin IN-318A. Gives characteristics of the asbestos-based, non-hardening sealer. Johns-Manville.
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## OTHER EQUIPMENT

**For Paint Spraying**—Details on a paint spray process in which a hydrocarbon compound is vaporized and used to atomize and apply the paint are presented in this 8-pp bulletin. Advantages of the process in application of thick or thin coats are described and equipment is illustrated. John J. Fannon Products Co.
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**For Automated Mining**—Equipment designed to increase automation in the non-metallic mining and manufacturing industries is pictured and described in Bulletin G-11. Summarizes capabilities of ten different types of mining and processing equipment, including pneumatic conveyors, compressors, pumps, blowers, coolers, preheaters, control panels, material-level indicators, feeders and valves, safety switches. Fuller Co.
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You'll save time in ordering bulletins by using the Reader Service Cards on page 256. Of course we honor letterhead requests—but it takes us somewhat longer to handle them.

**Dust Control Equipment**—Illustrated and described in 12-pp Bulletin 271 are four main types of dust control products—dry centrifugals, wet collectors, fabric collectors and electrostatic precipitators. Covers capacities and specific applications. American Air Filter Co., Inc.
▲ For a copy, circle 183 on Post Card

**Gas Turbine**—Bulletin SAE-109A describes a gas turbine for industrial and other applications. Performances specifications, dimensions and installation data are included, along with review of application potential. General Electric Co.
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**Incinerator Stoker**—Illustrated and described in Bulletin 701 is a reciprocating grate incinerator stoker for the destruction of municipal and industrial garbage and refuse. Features are detailed. Detroit Stoker Co.
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## Recommended for Your Reference Library

**Paint Economy**—Factors to consider in selecting paints are detailed in this sixth edition of "Engineered Color," a 20-pp specifications catalog. Covers proper use of paint and color, requirements of various surfaces, color and the safety program. Describes interior and exterior primers and finishes, varnishes and floor sealers, and includes detailed specifications and color chips. Barreled Sunlight Paint Co.
▲ For a copy, circle 180 on Post Card

**Solid Lubricants**—The theory and practice of lubrication by solids are discussed in 24-pp Bulletin 124. Tells advantages of molybdenum disulfide solid lubricants. The Alpha Molykote Corp.
▲ For a copy, circle 181 on Post Card

**Super Alloy Tubing**—Using text, tables, graphs and photos, 16-pp Bulletin 71 is designed as a short course on super alloy tubing. It explains properties and characteristics of alloys for high-temperature strength, covering materials and chemical composition, mechanical-physical properties, short-time tensile properties at elevated temperatures, stress rupture data. Superior Tube Co.
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**Three-Dimension Models** — Advantages of using three-dimensional scale models in planning new construction, expanded facilities, improved utilization of space etc. are treated in this 8-pp bulletin. Illustrates some individual product models as well as industry groups of equipment and examples of complete model installations. Among these are a foundry and machine shop, steel warehouse, extension to power station. Knight Models Inc.
▲ For a copy, circle 186 on Post Card

**Organic Chlorine Compounds** — This 44-pp catalog describes use of organic chlorine compounds as solvents, extractants, fumigants, intermediates, and special-purpose fluids. Contains comprehensive data on 13 organic chlorine compounds, including physical properties, cleaning formulations, toxicological properties, storage and handling, test methods, and selected literature references. Union Carbide Chemicals Co.
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**Pumping and Hydraulic Data** — Definitions, formulas, testing, tables, charts and definitions useful in pumping and hydraulics are covered in 20-pp Bulletin EM-77. Includes facts on how to figure NPSH, pump efficiency, mechanical and electrical equivalents, and pipe friction loss chart, weir table. Peerless Pump Div., Food Machinery and Chemical Corp.
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**Plastics Guide**—Detailed price and selection data on a variety of plastics is presented in this 64-pp catalog, including specifications for linear or semi-rigid polyethylene sheets and rolls and similar data. Table of properties of plastic materials is included. Cadillac Plastic and Chemical Co.
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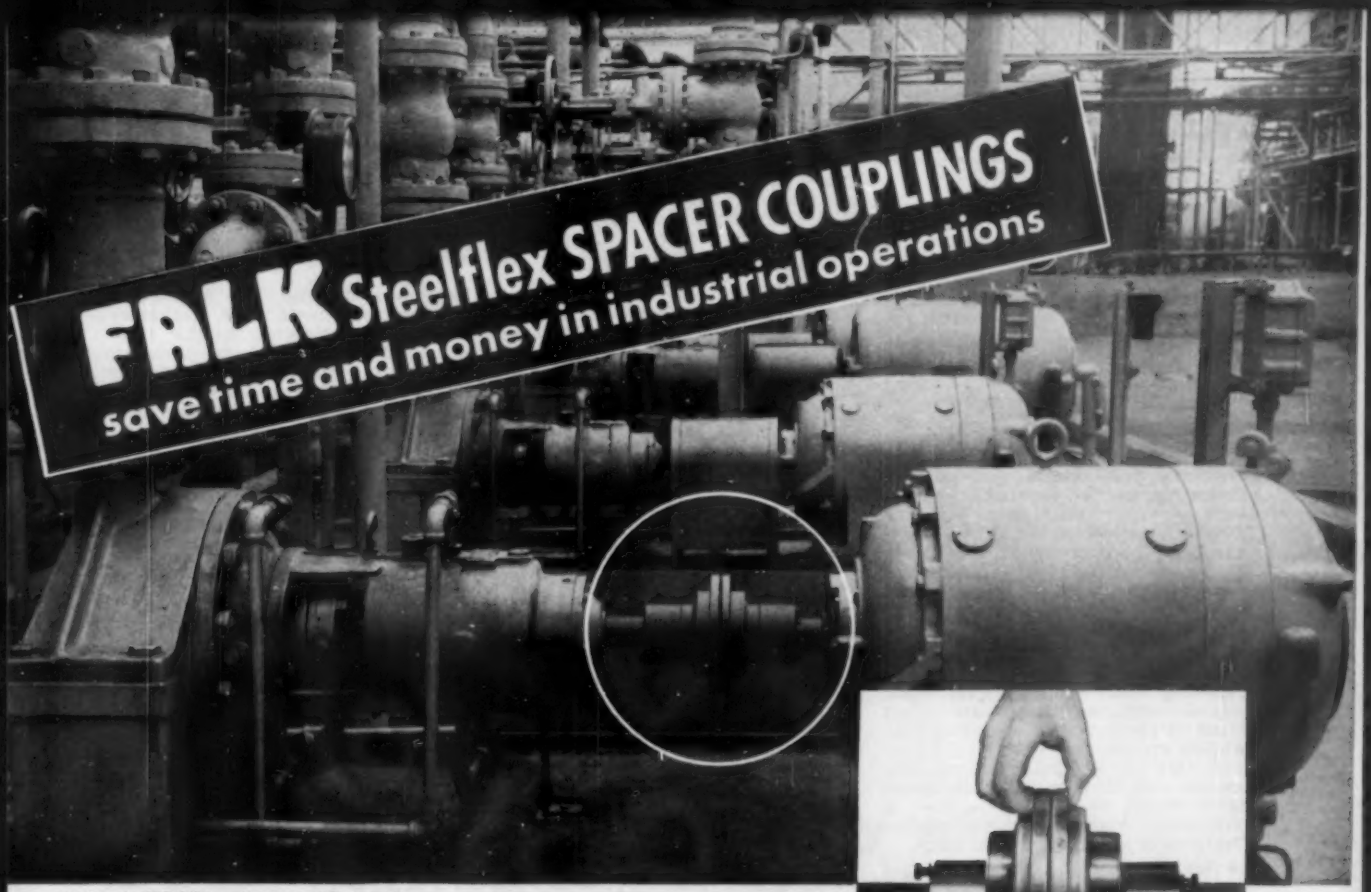


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Here's another saving: with the FALK Spacer Coupling, you can quickly realign shafts *without the usual loss of operating temperature!*

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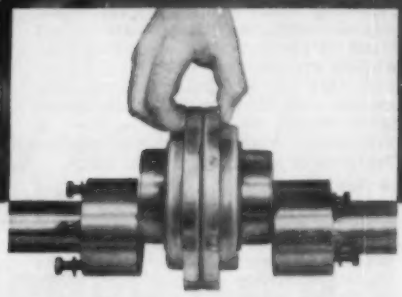

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Second, compress Spacer to fit space between hubs and tighten cap screws to pull spacer hubs into the registered fit.

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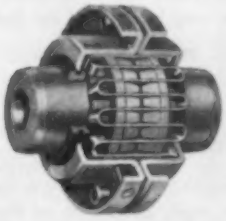

**The heart of the FALK Spacer ...the basic Type F Steelflex**
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**FALK**
...a good name in industry

# BULLETINS

(Begins on page 21)

**Vibration, Noise Control**—Eight-pp Bulletin K4G gives engineering specifications and performance data for a variety of products for control and measurement of machinery vibration, shock and noise. Selection chart is included. The Korfund Co., Inc.

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**Controlled Atmosphere Systems** — Bulletins W-14545 and W-14546 describe modular controlled atmosphere equipment and systems. Covers dryboxes, dust shields, and vacuum ovens for use in electronic component assembly, pharmaceutical production and packaging, chemicals handling, plastics production, toxic materials handling, atmosphere and contamination control, control and elimination of environmental variables. Philco Corp.

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**Rotating Shaft Seals** — Custom-designed mechanical shaft seals for all types of products and operating conditions are featured in 34-pp Catalog 660. Data on general operating ranges and limitations which determine choice of seal to be used is presented, along with construction features of seals. Cartriseal Corp.

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**Automatic Tape Analyzer**—Bulletin WC-127 covers all facets of an automatic tape analyzer for measuring trace quantities of insoluble solids in liquids, including operation principles, applications and specifications. Graver Water Conditioning Co.

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**Water-Cooled Condensers**—Eight-pp Bulletin WC-300 describes mechanically cleanable water-cooled condensers for refrigeration and air conditioning. Emphasizes advantage of true counterflow for maximum heat exchange over total tube lengths. Condensers listed are refrigeration and air conditioning systems requiring minimum space; sizes range from 1/3 to 25 tons. Charts showing water consumption and pressure drops are included. Halstead & Mitchell Co.

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**Crushers, Mills**—Bulletin 4020 illustrates and briefly describes each type of crusher in company's line, and indicates typical applications. It is a guide to preliminary crusher selection and keyed to more detailed bulletins on crushers. Pennsylvania Crusher Div., Bath Iron Works Corp.

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**Magnet Wire**—Catalog WC-8289 contains 50 pp of comprehensive selection data on magnet wire. A feature is guide to preliminary selection of wires according to insulation and other requirements. Nomograms are included for computing cross-sectional areas, resistance, and weight of rectangular conductors. General Electric Co.

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**Commercial Glasses**—Properties of selected commercial glasses are detailed in 16-pp Booklet B-83 (Rev). Covers thermal stress, heat transmission, electrical properties, corrosion resistance and viscosity data, as well as a temperature conversion table. Corning Glass Works.

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**Instrumentation Tubing**—Basic facts about all types of small diameter tubing for instrument applications are presented in 12-pp Bulletin 380. Covers applications, required characteristics, materials specified, size range, length, tolerances and tempers. Superior Tube Co.

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**Write-on Labels**—Eight-pp Bulletin 131, illustrated in color, shows stock and special labels on which you can write, type, stamp or punch. Tells where to use the labels and benefits offered. A variety of types are presented along with size and price data. W. H. Brady Co.

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**Machinery Mounts**—This 6-pp bulletin describes three basic machinery mounts manufactured by this company, tells how they control vibration, simplify and reduce costs of machine installation, allow machines to operate at higher speeds. Includes data on loading ranges. Unisorb Div., The Felters Co.

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# DATA FILE of literature for the plant engineer's library

**STANDARD CATALOGS, bulletins and handbooks are listed to help plant engineers maintain a permanent data file. To get these free catalogs, circle item numbers of those wanted on postage-free cards provided on pages 255 and 256.**

## HEATERS, HEATING

**Infra-Red Heating**—Bulletin Pc 1-59 gives specifications and dimensions on infra-red radiant heaters, including a hooded unit, which use any commercial gas for fuel and need no electrical power source. Describes construction features, control arrangements. Panelbloc Div., Bettcher Mfg. Corp.

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**For Radiant Heating**—Eight-pp. "Radiant Heating Slab Construction" is an illustrated report on accepted installation procedures for radiant heating systems. Arranged in order of preference are sketches of various types of construction. Each shows position of wrought iron pipe coils in the concrete slab, as well as relationship of coils and slab to structural features. A. M. Byers Co.

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**Make-up Air Solutions**—Bulletin EN-5911 explains how make-up air properly introduced and tempered overcomes negative air pressure and eliminates problems arising when fans draw fumes, smoke or odors. Outlines design of a make-up air system and tells how to select correct equipment. Also includes schematic diagram and instructions for wiring control arrangement. Reznor Mfg. Co.

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**Electric Comfort Heating** — Six-pp Bulletin F-975C illustrates Chromalox electric comfort heaters, including convection, forced-air and radiant heaters that may be surface mounted, built into the wall or installed in a duct system. Wall mounted thermostats, both line and low voltage models, are also shown. Edwin L. Wiegand Co.

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**Gas-Fired Heaters**—Detailed information on gas-fired industrial type vertical delivery unit heaters is presented in 6-pp Bulletin IGV-660. Cutaway view showing internal details is included, as well as dimensional data and diagrams, performance data and specifications. Modine Mfg. Co.

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**Heating, Air Conditioning**—Featured in 20-pp Bulletin B-151A is company's line of air conditioning and heating equipment. Illustrated and described are air conditioning units, convector radiators, perimeter heating, hot water heating equipment, heating system controls, and unit heaters. Warren Webster & Co.

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**Hot Water System**—How to provide hot water for the variety of requirements of an industrial plant without stretching the hot water system too far is the problem covered in this series of ring-bound bulletins. Various types of water heaters for commercial and industrial applications are illustrated. A. O. Smith Corp.

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## FANS, VENTILATING AND AIR CONDITIONING

**Propeller Fans**—Detailed information on a line of propeller fans and accessories is presented in 20-pp Bulletin A-109E. Dimensional tables, ratings for single, two-propeller and multiblade fans are included. Hartzell Propeller Fan Co.

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**Air Moving Equipment**—Bulletin DB-45, 20-pp. contains detailed information on company's line of roof ventilators, bifurcators, axial flow vent sets, and air jets. Bonded performance ratings are listed on table, and dimensions given. DeBothezat Fans Div., American Machine and Metals, Inc.

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# Descale boilers, heat exchangers, condensers

## easily, more safely with non-fuming Dry Acid Cleaners based on Du Pont Sulfamic Acid

**EASIER TO USE**
Just scoop the dry acid cleaner from lightweight, disposable drum into make-up tank. Often can be added directly to steam-generating, condensing and similar equipment . . . no elaborate apparatus or specially trained personnel required.

**SAFER TO HANDLE**
These cleaners are dry, non-fuming powders. No danger of broken carboys, spattered liquids, corrosive fumes with sulfamic-based cleaners.

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1 lb. of dry acid cleaner does the job of 1.5 lbs. of hydrochloric acid. You'll save on shipping, handling and storage costs.

**LESS CORROSIVE**
Sulfamic acid is less corrosive than hydrochloric acid; on brass, 60% less; on steel—70%; copper—85%; aluminum—80%. This low corrosion rate permits use with the equipment's own pump. And, with the proper inhibitor, it can be used safely on galvanized steel.

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# DATA FILE

(Begins on page 260)

**Air Engineering**—Bulletin E-57 is a 24-pp air engineering data file covering engineering and test facilities for propeller fans, specifications, construction, maintenance, and installation. Tables for estimating air-handling requirements provided. Aerovent Fan Co., Inc.
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**Exhauster Fans**—Featured in 16-pp Catalog 707 is a line of exhausters with cast iron housings and sideplates for a wide range of industrial services. Performance tables, dimensions are included. Clarage Fan Co.
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**Plastic Ventilating Equipment**—Illustrated and described in 18-pp Bulletin B-500 are plastic ventilation products, including ventilating ducts, fittings, exhaust hoods, stacks, covers, fans, and fume scrubbers. Physical and chemical properties of glass-reinforced plastics are detailed. Heil Process Equipment Corp.
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**Zone Control Cabinets**—Air conditioning zone control cabinets are described and illustrated in 20-pp Bulletin AC-220. Separate sections with tables, curves and sketches cover proper unit selection, physical data, dimensions. Buffalo Forge Co.
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**Liquid Absorbent Conditioner**—Operation of company's air conditioner using a hygroscopic liquid absorbent is detailed in Bulletin 140. Diagram illustrates details of the conditioner and concentrator and graph shows water vapor equilibrium. Niagara Blower Co.
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## SAFETY, FIRE PROTECTION

**Fire-Resistant Fluids**—This series of specification sheets describes company's line of fire-resistant fluids including synthetic, oil-in-water and water-in-oil emulsion and glycol types. Physical characteristics given. Mobil Oil Co., Inc.
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**Handling Flammable Liquids**—Problems involved in the use of flammables in individual processes, and methods and equipment required for safe control are described in this 76-pp safety handbook. Physical properties and characteristics of most commonly used flammables are detailed; recommendations for safe handling given. The Protectoseal Co.
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**Special Fire Protection**—Devoted to special fire protection, this 44-pp booklet covers both equipment and methods. Tells how to recognize special fire-hazards conditions in a plant. Discusses in detail major types of fire protection, telling how each functions, giving its advantages and limitations. Grinnell Co., Inc.
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## VALVES, PIPING, FITTINGS

**Choosing the Right Valve**—Importance of choosing the right valve is stressed in this 20-pp Bulletin AD-2016. Describes three principal valve types—gate, globe and check valves—their design and service characteristics, lists names of valve parts, describes disc-stem connection, bonnet and bonnet-joint characteristics, materials. Crane Co.
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**Ball Valves**—Thermoplastic ball valves of unplasticized polyvinyl chloride and Penton are described in Bulletin TTP-180. Design features and corrosion - resistance characteristics are detailed. Tube Turns Plastics, Inc.
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**Corrosion-Resistant Valves**—Bulletin V-4b describes corrosion resisting valves with Teflon sleeves. Details of construction are illustrated and valve dimensions and other data tabulated. The Duriron Co., Inc.
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**Stainless Steel Valves**—Corrosion resistant stainless steel valves are featured in 32-pp Catalog 59SS. Features of design and construction are shown through cutaway views, and advantages of stainless steel in withstanding corrosive chemicals and atmospheres detailed. Jenkins Bros.
▲ For a copy, circle 322 on Post Card

**Valve Buyers Guide**—Detailed information on bronze, steel and iron valves, and valves made of corrosion-resistant metals and alloys is presented in 24-pp Form 186. Covers angle valves, check valves, gate valves, globe valves, liquid level valves, lubricated plug valves, needle valves, relief valves, sampling valves, steam jacketed ones. The Wm. Powell Co.
▲ For a copy, circle 323 on Post Card

**Butterfly Valves**—Resilient-seated type butterfly valves for applications where positive tight closure is required are illustrated and described in Bulletin 590X. Advantages and outstanding features are detailed. W. S. Rockwell Co.
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**Automatic Valve Actuator**—Catalog V-200 describes the Valvmatic, a valve actuating unit designed for converting hand-operated valves to automatic operation. Advantages are detailed and a drawing shows design features. Photos illustrate installation. C. H. Wheeler Mfg. Co.
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**Steam Traps**—This 1960 Condensed Catalog contains 12-pp of technical details, dimensions, and capacity data on steam traps, temperature regulators, and heating specialties. Cutaway views and diagrams are included. Sarco Co., Inc.
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**On Steam Traps**—Catalog K is an enlarged 48-pp manual and steam trap catalog. New material provided includes open float and thermostatic traps, pipe strainer to 6 in. steel and semi-steel, and helpful steam pipe sizing tables. Discusses fundamentals of good trapping, trap selection, installation. Armstrong Machine Works.
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**PVC Pipe, Fittings**—This 12-pp bulletin contains latest technical information on polyvinyl chloride pipe and fittings, including advantages and properties, general characteristics and applications, physical flow rate charts and complete specifications. Also included is a chemical resistance chart. Mueller Brass Co.
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**Stainless Steel Strainer**—Bulletin SS-143 features a stainless steel strainer for high pressure and high temperature steam service and for use with many liquids, gases and chemicals. Table of pressures and temperatures is included. Strong, Carlisle & Hammond.
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**Valve Couplings**—Illustrated and described in Bulletin 593 is a line of valve couplings and hose couplings with quick disconnect feature. A table of standard dimensions is included along with other data. Hunt Valve Co.
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**Fluid Line Coupling**—Catalog 100 contains data sheets describing company's line of quick-connective fluid-line couplings for pneumatic, hydraulic, oxygen, acetylene, steam, various gases and liquids service. Dimensions included. The Hansen Mfg. Co.
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**Expansion Joints**—Twelve-pp Bulletin EJ-1917 describes advantages of company's Gun-Pakt expansion joints with either welding or flanged ends. Section on figuring expansion of pipe lines, expansion joint installation suggestions, and complete specifications included. Yarnall-Waring Co.
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**Swivel Joints**—Detailed information on company's line of swivel joints for a variety of industrial applications is presented in 24-pp Bulletin G-5. Basic types of swivel joints and their applications are detailed and complete specifications and dimensional data included. Chiksan Co.
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## DUST, FUME CONTROL

**Dust Collectors**—Self-contained cabinet cloth-filter type dust collectors are illustrated and described in this 6-pp Bulletin 359. Design details included. Torit Mfg. Co.
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**Dust Collector**—Operating principle and construction features of a reverse jet fabric dust collector are detailed in 8-pp Bulletin 279C. Includes application and size data. American Air Filter Co., Inc.
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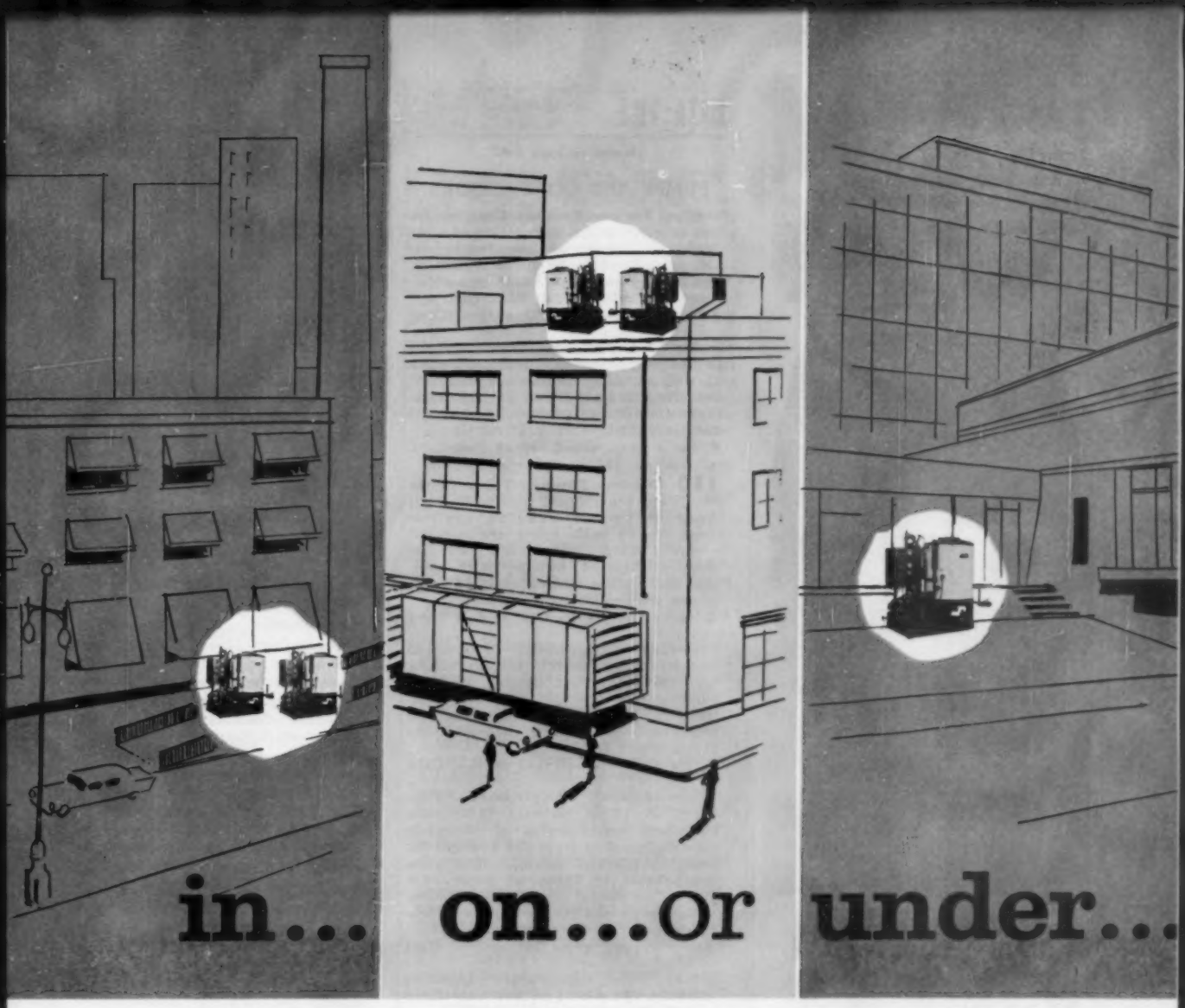
**Dust Collector**—Bulletin 10-26-59 describes a dust collector with cyclone tubes mounted between the inlet and discharge tube sheets making possible an unobstructed inlet plenum, preventing material buildup and plugging. Dustex Corp.
▲ For a copy, circle 336 on Post Card

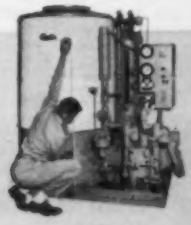



# Leading beverage company proves "Steam The Modern Way" saves space

Illinois plant installed two 100 HP Claytons IN old smokestack ash pit, releasing many sq. ft. for plant expansion. Louisiana facility placed two lightweight Claytons ON the roof. California plant located Claytons easily UNDER loading dock.

This, indeed, is "Steam the Modern Way"... a 175 HP Clayton takes just 4 ft. x 7 ft. of floor space, stands just 8 ft. high. Write for full information on how Claytons can solve *your* space problems.

See Clayton Exhibit, National Power Show—N.Y.—Nov. 28-Dec. 2. Booth 171. 422



175 HP

Clayton

Steam Generators

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Remove all traces of
**OIL**
from compressed air lines . . .
**NEW WILKERSON**
**"WHIRLFLO"**

For air lines ¼" to 5" P.T.
with or without pipe flanges.

**Exclusive features of NEW Wilkerson "WHIRLFLO"**

★ Metal bowl or transparent bowl.
★ "Micro-Pruf" cartridge completely removes oil and particles as small as 3 microns—lasts 4 times longer.
★ 200% greater CFM capacity. Maximum pressure 250 PSI with metal bowl.

**Put the "WHIRLFLO'S" double-barreled action to work for you.**

1. Centrifugal force from special baffle vane sends contaminants to walls of cylinder AWAY from cartridge, from where they drain into sump.
2. Then separated air flows through "Micro-Pruf" cartridge. This 2-stage action cleans better and adds months of life to cartridge.

**SAVE on maintenance and operation.**

1. The cartridge lasts 4 times longer than others.
2. Cartridge is easily replaced by removing one nut while unit remains on pipe line.
3. Addition of automatic petcock eliminates human failure to drain, keeping cartridge from water level.

**WRITE TODAY FOR COMPLETE INFORMATION ON THE EFFICIENT, MONEY-SAVING WILKERSON "WHIRLFLO."**

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# DATA FILE

(Begins on page 260)

## PUMPS AND COMPRESSORS

**Vertical Turbine Pumps**—Featured in this product bulletin is a line of vertical turbine pumps job-engineered to suit specific applications in industry. Design, construction details noted. Fiese & Firstenberger Mfg., Inc.
**For a copy, circle 337 on Post Card**

**Liquid Pumps**—Heavy-duty liquid pumps for pumping paints and inks as well as other abrasive liquids are described in Data Sheet SP-507. Features are illustrated and dimensional data included. Viking Pump Co.
**For a copy, circle 338 on Post Card**

**110 Nuclear Pumps**—This bulletin describes centrifugal pumps for all types of nuclear pumping applications. Three basic types are covered —liquid metal, liner-motor and mechanically-sealed pumps, with general description and capacity ratings. Byron Jackson Pumps, Inc.
**For a copy, circle 339 on Post Card**

**Pipeline Compressors**—Mechanical and hydraulic design considerations for two-stage centrifugal pipeline compressors are detailed in 10-pp Bulletin 187. Charts, diagrams and important calculating formulae are given. Clark Bros. Co.
**For a copy, circle 340 on Post Card**

**Water-Cooled Compressors** — Featured in 12-pp Bulletin WB10 are two-stage water-cooled air compressors designed to meet the demand for small machines having efficiencies comparable to those of large two-stage horizontal compressors. Cutaway views showing component features included. Gardner-Denver Co.
**For a copy, circle 341 on Post Card**

**Heavy Duty Compressor**—Eight-pp Bulletin 350 describes and illustrates a horizontal, watercooled single-stage, heavy duty compressor designed to fit most compressed air applications. Photos, line drawings and cross-sectional views illustrate construction. Pennsylvania Pump & Compressor Co.
**For a copy, circle 342 on Post Card**

**Industrial Compressors**—Oil-free heavy-duty industrial compressors are illustrated and described in 12-pp Bulletin A-92. Cutaway views show details of internal design and construction, and bulletin includes photos of installations. Joy Mfg. Co.
**For a copy, circle 343 on Post Card**

**Stationary Compressors**—Sixteen-pp Catalog 5910 describes features and advantages of a line of stationary air compressors designed for a variety of industrial needs. Tables of weights, code words, and dimensions are included. Schramm, Inc.
**For a copy, circle 344 on Post Card**

**To Speed Construction** — Portable compressors, tractor compressors designed especially to speed work and reduce costs of construction are described and pictured in 8-pp Bulletin CG-15. Also presented are pneumatic air tools for use with the portable

**FUEL COSTS DROP 40% with DRAVO COUNTERFLO HEATERS!**

**The problem . . .** after plant expansion, 48,600 square feet of widely varying construction had to be heated efficiently. Some roofs were uninsulated, and large truck doors let in frigid air during winter. The old coal-fired steam heating plant was inadequate; a new heating system was needed. Management compared costs of various heating methods, including probable maintenance expense, and arrived at the following conclusion:

**The solution . . .** Dravo forced air space heaters. Floor mounted, thermostat controlled Dravo *Counterflo* heaters met requirements for comfort heating. Truck entries were protected by discharge nozzles aimed to provide a protective blanket of warm air. Each area was maintained at the desired temperature level. Drafts were eliminated, and heat loss to roof areas held to a minimum. Heating costs were lowered by 40%, a saving of *$.06 per square foot.*

**Bonus benefits . . .** include very low maintenance costs. A combination fireman-watchman was no longer needed—additional savings. The elimination of the boiler plant added 600 square feet of usable floor space. Use of Dravo Heaters permitted the installation of an automatic fire and burglar protection system, reducing insurance costs. Total savings to this company as a direct result of the installation of Dravo Heaters—$5,800 a year.

**More information . . .** on how Dravo *Counterflo* Heaters can help you lower heating costs. Send the coupon for details on the case history outlined above and full information on economical, high efficiency Dravo Space Heaters.

**DRAVO**
CORPORATION

Department P-14, Room M-214
Pittsburgh 25, Pa.

Send free bulletins on warm air space heating and the facts on the company mentioned above.

Name _____
Company _____
Address _____
City _____ Zone ____ State ____

**For more facts circle 663 on Reply Card**

## New Way to Stop Faucet Leaks!

★ 9-in-10 washers are fastened with TOO LONG or SHORT SCREWS thus loosen and destroy themselves. Leaks quickly follow!

**34 YEARS OF RESEARCH REVEALS NEW SOLUTION**

★ New, patented 'Sexauer' SELF-LOCK screws have imbedded expanding NYLON PLUG. They lock at required depth AUTOMATICALLY, hold washers firmly! Made of MONEL, they are rustproof, non-corroding. Heads can't twist off. Screw slots can't distort.

★ NEW, improved 'Sexauer' EASY-TITE faucet washers are made of super-tough, pliable du Pont compound (not rubber or fibre). Reinforced, like a tire, with a vulcanized layer of Fiberglas, they resist distortion and splitting from shut-off grind and squeeze.

★ Faucet leaks repaired with 'Sexauer' EASY-TITE washers and SELF-LOCK screws outlast ordinary repairs "6-to-1"!

**HIDDEN COSTS OF FAUCET LEAKS!**

Hackensack, N.J. Water Co. and American Gas Association figures prove stopping just ONE PIN-HOLE SIZE (1/32") LEAK saves you 8,000 gal. water quarterly. A HOT WATER FAUCET LEAK repair saves you over $7.58 QUARTERLY in fuel and water bills. Fewer leaks also produce important savings on MATERIALS, LABOR and COSTLY FIXTURE REPLACEMENTS!

A 'Sexauer' Technician will make available our NEW Catalog, Edition "J", listing our entire line of over 3,000 TRIPLE-WEAR plumbing repair parts and tools. He will survey your fixtures, determine the repair parts needed and establish an efficient stock arrangement and control to prevent costly overstocking or shortages. You get this service without obligation. *Act now!*

J. A. Sexauer Mfg. Co., Inc., Dept. S-110
2503-05 Third Ave., New York 51, N.Y.

*Please send me a copy of your Catalog "J"*

Name _____ Title _____

Organization _____

Bus. Address _____

City _____ Zone _____ State _____

SEXAUER

For more facts circle 664 on Reply Card

compressors. LeRoi Div., Westinghouse Air Brake Co.
▲ For a copy, circle 345 on Post Card

### PACKINGS, SEALS, GASKETS

**Cup Packings**—Properties and characteristics of Rex-Syn cup packings—a combination of a plastic resin elastomer—are described in this bulletin. Gives standard sizes for Rex-Syn and outlines results of field tests. E. F. Houghton & Co.
▲ For a copy, circle 346 on Post Card

**Self-Lubricating Packings**—Featured in this 30-pp Bulletin PC-103 is detailed information on company's line of packings with internal lubrication. Application chart, table of physical properties, and ordering instructions. Greene, Tweed & Co.
▲ For a copy, circle 347 on Post Card

**Mechanical Seal**—Performance and design features of Mechanipak PK mechanical seals for a variety of operating conditions are detailed in 8-pp Bulletin AD-150. Cutaway views, diagrams and tables of dimensional data included. Garlock, Inc.
▲ For a copy, circle 348 on Post Card

**O-Ring Handbook**—Catalog 5711 is a 24-pp design and data book on Viton O-rings. Contains test information on some 150 fluids and gases to which this synthetic elastomer is compatible; recommended design techniques; general information on three compounds and dimensions; and data on all standard sizes. Among technical material provided are do's and don'ts regarding Viton O-rings, compression set graph. Parker Seal Div., Parker-Hannifin Corp.
▲ For a copy, circle 349 on Post Card

**Impregnated Felt Gasketing**—Featured in this product bulletin is TFE-fluorocarbon impregnated felt for gasketing under extreme conditions. Properties and potential uses are detailed and a table of physical properties is included. E. I. Du Pont De Nemours & Co., Inc.
▲ For a copy, circle 350 on Post Card

### ELECTRICAL

**Drip-Proof Motors**—Bulletin 857 contains 12-pp of detailed information on company's line of open drip proof and totally enclosed fan cooled motors. Construction features are described and table of engineering data are included. Brook Motor Corp.
▲ For a copy, circle 351 on Post Card

**Trolley Busway System**—Three bulletins offer help on electrical installations involving cranes and hoists, assembly and production lines, test lines and other moving electrical equipment. Bulletin 60, 40-pp, covers 60 amp systems; Bulletin 70, 32-pp, covers 225-500 amp systems; Bulletin 75, 44-pp, covers 100 amp systems. Each includes special section on installation planning and procedure, mounting. Feedrail Corp.
▲ For a copy, circle 352 on Post Card

**Distribution Panelboards**—Bulletin 403 describes quick-make, quick-break distribution panelboards using shuttle break fusible switches. Appli-

# NEW CATALOG

## tells how to cut D. C. motor operating costs

...with Ideal Preventive Maintenance products—a complete line of Resurfacers, Flexible Abrasives, Precision Grinders, Brush Seaters, Commutator Cleaners, Mica Undercutters and other tools—designed to eliminate high repair costs and keep your motors at top efficiency with low-cost prevention methods. Used and endorsed by many of the nation's largest companies.

***Get It Now—Send Coupon***

IDEAL INDUSTRIES, Inc.
3879-K Park Avenue, Sycamore, Ill.

Send new Motor Maintenance Products Catalog free.

Name _____

Company _____

Address _____

City _____ Zone _____ State _____

Sold Through America's Leading Distributors

For more facts circle 665 on Reply Card

MAKE YOUR OWN

HERC-ALLOY

CHAIN ASSEMBLIES

without delay with . . .

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Hammerlok®

COUPLING LINK

- NO PEENING
- NO WELDING

PLUS HERC-ALLOY CHAIN, OBLONG MASTER LINKS AND SLING HOOKS ALL AVAILABLE FROM YOUR CM CHAIN DISTRIBUTOR

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CM CHAIN

For more facts circle 666 on Reply Card


## DATA FILE

(Begins on page 260)

cation and rating data is included, along with illustrations of performance details. Frank Adam Electric Co.

▲ For a copy, circle 353 on Post Card

**Individually Enclosed Breakers**—Featured in 8-pp Bulletin 4261-2B are individually enclosed-low-voltage power circuit breakers featuring visible break disconnect contacts. Selection chart, application data given. I-T-E Circuit Breaker Co.

▲ For a copy, circle 354 on Post Card

**Electrical Controls**—Featured in this 80-pp Bulletin LO-11 is a line of electrical control equipment, including safety switches, service control, load centers, and accessories. Describes design and construction features, and includes detailed selection tables and case dimensions, wire tables. Cutler-Hammer Inc.

▲ For a copy, circle 355 on Post Card

**Power Panelboards**—Bulletin VBP-470 contains 18 pp of information on features, design and operation of company's fusible Vacu-Break power panelboards. Contains circuit and dimension data, trim data, and suggested specifications on the units. Bulldog Electric Products Div., I-T-E Circuit Breaker Co.

▲ For a copy, circle 356 on Post Card

**Electric Safety Switch**—Design features and advantages of company's electric safety switches are outlined in this product Bulletin PL-250. Component details are illustrated and described and selection table included. The Clark Controller Co.

▲ For a copy, circle 357 on Post Card

**Enclosed Switches**—Catalog 83, 22-pp, Catalog 84, 16-pp, and Catalog 101, 24-pp, describe enclosed switches for industrial uses. Included are general switches designed for use on either a-c or d-c applications, sealed switches, heavy-duty limit switches, hand operated switches, and other types. Micro Switch Div., Minneapolis-Honeywell Regulator Co.

▲ For a copy, circle 358 on Post Card

**Control Batteries**—Twelve-pp Bulletin CP-539 describes batteries for control, switchgear and auxiliary power. Construction details are illustrated and described, and specifications are given as well as discharge curves. C & D Batteries, Inc.

▲ For a copy, circle 359 on Post Card

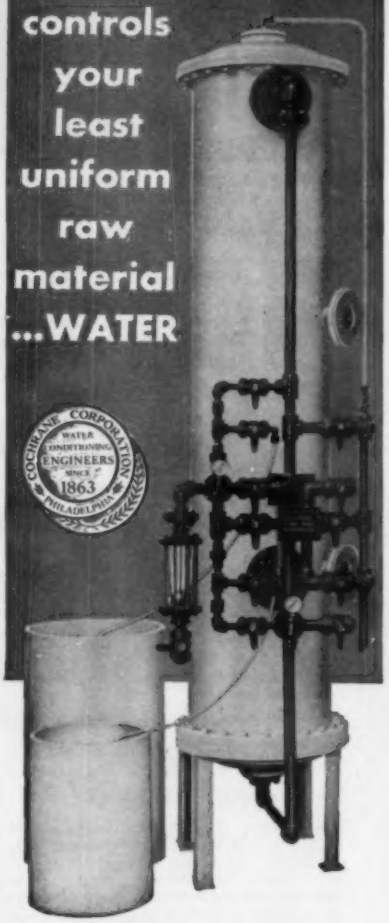
**Battery Technology** — Bulletin GB-1896 is a 36-pp handbook of technical instructions and engineering data on the care of motive power storage batteries. Covers all phases of lead acid battery theory, operation and maintenance. Provides basic information on specific gravity changes, charging cycles. Gould-National Batteries, Inc.

▲ For a copy, circle 360 on Post Card

**Fuse Data**—Illustrated and described in this Product Booklet 3 is company's line of fuses for a variety of applications. Covers dual-element cartridge fuses, renewable fuses and


NEW COCHRANE UNI-PAC* PACKAGED DEMINERALIZER

controls your least uniform raw material ...WATER




Are seasonal changes in the mineral content of your water supply a costly headache? Maintain quality standards year round with this *new* Cochrane Uni-Pac Packaged demineralizer, designed expressly for process systems. Sizes to 3500 GPH factory assembled, easily installed and operated. Send for Publication 5819.

*Trademark

Cochrane

CORPORATION

3126 N. 17th Street, Phila. 32, Pa.

In Canada:

Cochrane Water Conditioning Ltd., Toronto

Representatives in 43 principal U.S. and foreign cities.

For more facts circle 667 on Reply Card

*The Company that cares enough to give you the best!*

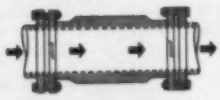
**Massco-Grigsby**

# PINCH VALVES

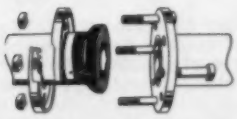
## RUBBER, NEOPRENE
### for Corrosion and Abrasion

- 1" to 14" inside diameter.
- Pressures to 150 psi.
- Temperatures to 200° F.
- Patented "hinged" sleeve. Recesses serve as "hinges" during compression; reduce strain and permit tight closing.

- Cannot leak or stick.
- No working parts in contact with pulp or liquid; no packing glands.



- Unobstructed flow eliminates high friction loss.
- Remote control available.
- Can be equipped for automatic regulation.



- Split flanges and patented Flex Seal ends assure perfect seal.
- Closing mechanisms... manual handwheel; handwheel with chain and sprocket reduction unit; electric worm gear motor reducer; chain operated torque arm reducer; hydraulic; air-hydraulic.

**WRITE FOR NEW CATALOG...**

*Manufacturing Division*

**MINE AND SMELTER SUPPLY CO.**

3800 RACE STREET • DENVER, COLORADO
OFFICES AND AGENTS IN PRINCIPAL CITIES

**For more facts circle 668 on Reply Card**


**renewal links, one-time cartridge fuses, indicating one-time cartridge fuses, plug fuses and others. Economy Fuse & Mfg. Co., Div., Federal Pacific Electric Co.**
**For a copy, circle 362 on Post Card**

**Dual-Element Fuses**—Advantages offered by company's dual-element cartridge fuses are detailed in 12-pp Bulletin 1330. Describes knife-blade and ferrule types, and includes time current curves. Economy Fuse Div., Federal Pacific Electric Co.
**For a copy, circle 363 on Post Card**

**Protective Equipment Guide**—Form SPD is a 24-pp handbook on selection of protective devices for electric circuits, motors, appliances and apparatus, and is based on 1959 National Electrical Code. Besides providing suggestions on how to select right kind of protections, booklet provides motor tables. Bussmann Mfg. Co.
**For a copy, circle 364 on Post Card**

**Electrical Equipment Digest** — Electrical equipment illustrated and described in 160-pp Catalog Digest 142, includes load centers, circuit breakers, low voltage control, fusible service equipment and accessories, meter sockets and troughs, safety switches, panelboards, duct and fittings, starters. Square D Co.
**For a copy, circle 365 on Post Card**

**Electrical Equipment** — Collected in this bound catalog is a series of bulletins on company's line of electrical equipment, including electric motors, generators, motor-generator sets, switchboards and controls. Cutaway views showing details of design and construction are included. The Ideal Electric & Mfg. Co.
**For a copy, circle 366 on Post Card**

**Electrical Equipment** — Condensed Catalog No. 9 contains 48-pp of descriptive data on company's line of electrical products, including conduit bodies, conduit fittings, connectors, ground fittings and EMT fittings. Dimensional data and features are shown. Gedney Electric Co.
**For a copy, circle 367 on Post Card**

**For Corrosive Spots**—Sixteen-pp Bulletin 2699 on Condulets for corrosive locations, discusses corrosion-resistant properties of a variety of metals and finishes utilized. Charts show application of each. Also provides formal listings of Plast-A-Coat Condulets for hazardous and non-hazardous spots. Crouse-Hinds Co.
**For a copy, circle 368 on Post Card**

**Safety Mineral Insulated Cable**—Bulletin S-2-60, 20-pp, describes cable properties, applications, installation procedure, construction and performance characteristics, electrical and mechanical properties and wiring specifications of mineral insulated cable recommended for hazardous locations. Mineral Insulated Wire Div., General Cable Corp.
**For a copy, circle 369 on Post Card**

**Cable Support**—Described in 28-pp Catalog 5912 are two types of cable trays or tube raceways, the ladder type and the basket small opening type, for cable, wiring and tubing support. Detailed dimensional data, transverse loading data, specifica-


DON'T OVERLOOK

# STEAM SPECIALTIES

If you believe that it's often the little things that count, you will pay attention to such items as steam specialties. Often used in large volume, their performance can contribute substantially to profit or loss in your company's operations.

You will see at the Power Show such steam specialties as steam traps, strainers and separators, steam cleaners, controllers and regulators, temperature and pressure instruments, indicating and recording devices, as well as a complete range of power and allied equipment ready for your inspection.

Here is your opportunity to investigate, compare, and get the right answers, face-to-face, from the manufacturers themselves. Only at the Power Show can you see over 250 leading suppliers' products, all conveniently grouped together.

It's important to your job to be there.

2524

# 24th NATIONAL EXPOSITION OF POWER & MECHANICAL ENGINEERING

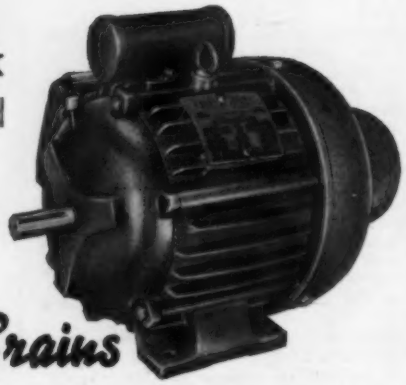
AUSPICES ASME

**NEW YORK COLISEUM**

**NOV. 28—DEC. 2, 1960**

MANAGEMENT: INTERNATIONAL EXPOSITION COMPANY
480 Lexington Ave., New York 17, N. Y.

this new Brook totally enclosed fan cooled, single phase motor has



Brawn and Brains

The BRAWN is in the rugged design, producing cool operation and long service life and in the housing, which keeps out dust and moisture . . . and the external fan which blasts cooling air over the heat dissipating fins on the housing.
The BRAIN is in the external centrifugal switch which positively disengages when motor has attained pre-set speed. Switch is on outside of motor for accessibility . . . just remove cap. No need to disassemble the motor or remove it from line for switch repairs. Same switch fits all sizes of motors . . . 1 to 5 HP.
You get real economy where dust, fumes or moisture are a problem. Dealers everywhere. Send for literature.

"World's Most Respected Motor"

BROOK MOTOR CORPORATION
3302-04 W. PETERSON AVE., CHICAGO 45, ILL.
IN CANADA: BROOK ELECTRIC MOTORS OF CANADA, LTD.
250 UNIVERSITY AVENUE, TORONTO

SINCE 1904
BROOK ELECTRIC MOTORS

For more facts circle 670 on Reply Card

More equipment manufacturers choose Fast's Couplings than any other gear-type coupling

Leaving other claims aside, the thing that counts in couplings is customer confidence—and industrial equipment manufacturers have made Fast's their overwhelming choice. The Fast's line is more diversified, too—in a complete range of sizes and types for shafts, from ½" to 32" and larger.

Every Fast's Coupling brings you superb engineering only the original gear-type coupling can deliver. Smooth-running units that are designed to outlast the machines they connect. Rapid service from experienced field engineers backed by outstanding stock facilities. Write today for full details on couplings to suit your needs to: KOPPERS COMPANY, INC., Fast's Coupling Dept., 1011 Scott St., Baltimore 3, Maryland.

KOPPERS
FAST'S COUPLINGS
Engineered Products Sold with Service

For more facts circle 671 on Reply Card

## DATA FILE

(Begins on page 260)

tions, photos and diagrams are included. The Globe Co.
▲ For a copy, circle 370 on Post Card

**Rubber-Jacketed Cord** — Illustrated and described in this product bulletin is a line of rubber jacketed portable electrical cord. Construction details and advantages are covered. Western Insulated Wire Co.
▲ For a copy, circle 371 on Post Card

**Electrical Metallic Tubing**—Product uses, features and manufacturing processes of electric metallic tubing are detailed in 12-pp Bulletin RCP-900. Recommended applications are outlined, and charts are included which detail number of cables that each conduit size will accommodate. Rome Cable Div., Aluminum Co. of America.
▲ For a copy, circle 372 on Post Card

**Flexible Electric Conduit**—Performance and application data on company's line of flexible plastic covered electrical conduit, Liquatite, are featured in brochure. Electri-Flex Co.
▲ For a copy, circle 373 on Post Card

### LIGHTING, COMMUNICATION

**Modern Lighting Needs**—"Footcandles in Modern Lighting," is a 20-pp revised booklet giving lighting level recommendations for seeing tasks involved in hundreds of industrial and other activities. Figures are based on findings of Illuminating Engineering Research Institute and Illuminating Engineering Society. Also discussed are other aspects of lighting to be considered. General Electric Co.
▲ For a copy, circle 374 on Post Card

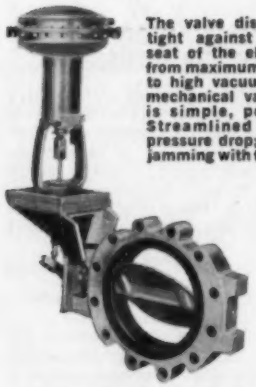
**Group Relamping Plan**—Eight-pp Booklet A-6832 describes a group relamping plan designed to reduce costs, provide better lighting, and cause fewer work interruptions. Sample calculations provide data for setting up a relamping schedule. Westinghouse Electric Corp.
▲ For a copy, circle 375 on Post Card

**Lighting Fixtures**—This 12-pp condensed catalog gives a compact presentation of company's fluorescent and Brascolite incandescent luminaries. Data on surface and pendant mounted units, recessed luminaries and Gratelite electric ceilings provided. Edwin F. Guth Co.
▲ For a copy, circle 376 on Post Card

**Emergency Lighting**—Twenty-pp Publication 243A features emergency lighting systems for commercial, industrial and other types of buildings. In addition to describing the systems, catalog contains complete information and specifications on all components. The Standard Electric Time Co.
▲ For a copy, circle 377 on Post Card

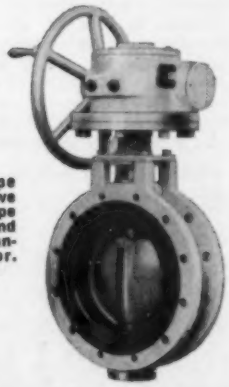
**Fixtures for Industry**—Details of the CFI—comfort for industry—the uplight fluorescent lighting fixtures are covered in Form OD-1022, 16-pp. Size and types, and specifications are included. Day-Brite Lighting, Inc.
▲ For a copy, circle 378 on Post Card

# TIGHT CLOSURE is NO PROBLEM with ROCKWELL BUTTERFLY VALVES



The valve disc seats drop-tight against the resilient seat of the elastomer liner from maximum line pressure to high vacuum. Manual or mechanical valve operation is simple, positive, fast. Streamlined design; low pressure drop; no fouling or jamming with foreign matter.

Wafer type butterfly valve with spool type rubber liner, available in "Keelok" snap-in, easily replaceable type or vulcanized to body. Shown with pneumatic operator. Bulletin 583.



Flanged type butterfly valve with spool type rubber liner and worm gear manual operator. Bulletin 582.

W. S. ROCKWELL CO.

2920 Eliot St., Fairfield, Conn.

For more facts circle 672 on Reply Card


**Paging System**—Features and advantages of company's selective, wireless paging system are illustrated and described in Form S-150. Describes components and typical installations. Stromberg-Carlson Div., General Dynamics.

▲ For a copy, circle 379 on Post Card

**Communication System**—Featured in this bulletin is a transistorized communication system designed to provide communication between two or more persons or departments regardless of distance or surrounding noise conditions. Gai-Tronics Corp.

▲ For a copy, circle 380 on Post Card

**Signal Equipment**—Tips on how to select suitable signals for any specific operations are offered in Bulletin 100. Describes horns, bells, warning lights, other signal equipment. Specifications, photos, wiring diagrams, dimensions, audibility rating charts. Federal Sign & Signal Corp.

▲ For a copy, circle 381 on Post Card

## INSULATION

**Flexible Pipe Insulation**—This bulletin describes Armaflex 22, a flexible foamed plastic insulation for piping. Gives advantages, physical properties, thickness recommendations and sizes. Tells how to apply it to new or existing piping and fittings. Armstrong Cork Co.

▲ For a copy, circle 382 on Post Card

**Piping Insulation**—Seven-pp Bulletin SO 1054 features a snap-on, one-piece molded pipe insulation of fine-glass fibers for hot or cold piping. Gustin-Bacon Mfg. Co.

▲ For a copy, circle 383 on Post Card

## BOILERS, AUXILIARIES

**Hot Water Boilers**—Featured in this Product Bulletin AD-188 is a line of hot water boilers with forced thermal circulation and high velocity tempering flow. Internal flow pattern is shown on cutaway, and design and test data given. Cleaver-Brooks Co.

▲ For a copy, circle 384 on Post Card

**Hot Water Boilers**—Catalog HCC-2, 20-pp describes and illustrates design, construction advantages and economies of company's controlled circulation hot water boiler for supplying high pressure, high temperature water for heating systems and process use. Combustion Engineering, Inc.

▲ For a copy, circle 385 on Post Card

**Packaged Steam Generators**—Bulletin B-3255 contains detailed information on shop-assembled steam generators in capacities from 10,000 to 60,000 lb of steam per hour. Advantages of construction, performance and maintenance shown. Titusville Forge Div., Struthers-Wells Corp.

▲ For a copy, circle 386 on Post Card

**Steam Generators**—Advantages of company's steam generators designed to adjust to actual production needs are detailed in this 6-pp Product Bulletin C-731. Schematic diagram showing operating details is included. Clayton Mfg. Co.

▲ For a copy, circle 387 on Post Card


TO BE "HOT" ON

# HEAT TRANSFER

For better answers to questions about heat transfer equipment, how present power-production methods compare with Magneto-HydroDynamics, how greater efficiency than today's 40% can be achieved—visit the Power Show.

The answers are easier, and your job potential better when you've seen the latest in such heat exchanger equipment as condensers, intercharges, feed water heaters, intercoolers, preheaters, after coolers—PLUS a broad line of other power and allied equipment.

Only at the Power Show do you have the opportunity to investigate, compare and get the right answers, face-to-face, from the manufacturers themselves. Only at the Power Show can you see over 250 leading suppliers' products, all conveniently grouped together at one time.

Make sure you're there. Everyone else will be!

Z480

# 24th NATIONAL EXPOSITION OF POWER & MECHANICAL ENGINEERING

AUSPICES ASME

NEW YORK COLISEUM

NOV. 28—DEC. 2, 1960

MANAGEMENT: INTERNATIONAL EXPOSITION COMPANY
480 Lexington Ave., New York 17, N. Y.

# How to get drier or cooler AIR or GASES

***at low cost***

NIAGARA *AERO* AFTER COOLER cools a compressed gas, or air, below the temperature of the surrounding atmosphere, thus preventing the condensation of moisture in your lines. The gas will contain only half of the moisture left in it by conventional methods. Even drier gas can be produced if you require it.

In working with controlled atmospheres of inert gases to prevent undesired reactions, this dryness of the gas at low cost is a great advantage. The cost of the Niagara method is low because it uses evaporative cooling, saving 95% of the cost of cooling water (and its piping and pumping). This direct saving of cost pays for the Niagara cooler in less than two years.

If you use compressed air to operate instruments or pneumatic equipment you will get better results by using the Niagara Aero After Cooler.

Write for Bulletin 130, or ask nearest Niagara Engineer if you have a problem involving the industrial use of air.

**NIAGARA BLOWER COMPANY**

**Dept. PE-11, 405 Lexington Ave., New York 17, N. Y.**

*Niagara District Engineers in Principal Cities of U. S. and Canada*

**For more facts circle 674 on Reply Card**

# Your ideal source for custom-designed cranes

# CONCO

A crane, custom-tailored in every detail to your client's needs, is available from Conco at a practical cost. Here you'll find engineering experience spanning 35 years, and unique plant flexibility that permits easy handling of specialized cranes — spark and explosion proof, indoor-outdoor, circular, and cranes employing closed circuit TV for remote-control operation. May we submit a proposal on your next crane requirement—whether standard or highly specialized.

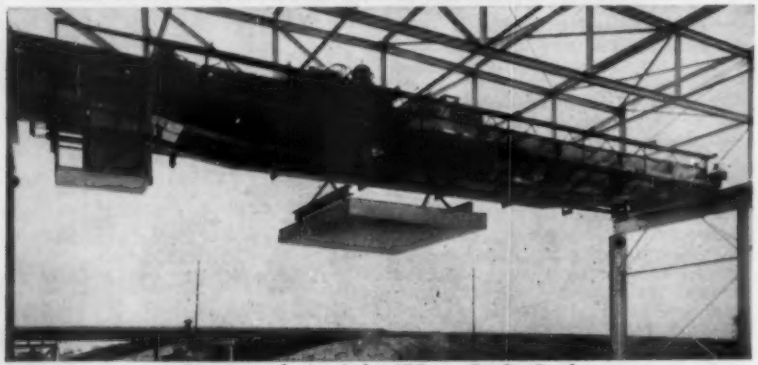
*Write for Bulletin*

**Material Handling Division**

**CONCO ENGINEERING WORKS, INC., Mendota 13, Illinois**

AFFILIATES { Spartan Tool Division—Powered Sewer Cleaning Equipment
Field Control Division—Barometric Draft Controls
Conco Building Products, Inc.—Brick, Tile, Stone

Conco CRB Electric Crane used for indoor-outdoor service at Underwriters' Laboratories, Chicago.



**For more facts circle 675 on Reply Card**


# DATA FILE

(Begins on page 260)

**Power Gas Burners**—Bulletin 2 describes a line of power gas burners with or without auxiliary oil burners. Advantages of design and operation are detailed and data tables giving gas input, maximum horsepower, maximum net standing radiation and other essential information included. Industrial Combustion Inc.

**For a copy, circle 388 on Post Card**

**Fuel Burning Equipment**—Comprehensive Catalog 6260 covers oil burners, gas burners, dual-fuel burners for gas and oil, forced draft package units, boiler-burners units, coal stokers, combustion control panels and the SelecTemp steam heating system. One section discusses selection of fuel and types of draft available. Iron Fireman Mfg. Co.

**For a copy, circle 389 on Post Card**

**Fuel Burning Systems**—Features and operations of fuel burning systems for oil, gas or combination oil/gas fuels are detailed in 8-pp Bulletin 1270. Typical burner arrangements are illustrated. Orr & Sembower, Inc.

**For a copy, circle 390 on Post Card**

## MECHANICAL POWER TRANSMISSION

**For Power Transmission**—This bulletin presents manufacturer's line of power transmission equipment. Contains brief description of major features of speed reduction drives; screw conveyor drives; adjustable speed drives; motor bases; and conveyor and split pulleys. The American Pulley Div. Van Norman Industries.

**For a copy, circle 391 on Post Card**

**Motors and Drives**—Eight-pp Bulletin 2650 describes company's line of a-c and d-c standard motors, special motors, gear motors and adjustable speed drives, for a broad range of industrial applications. Summarizes characteristics and modifications for 20 basic types of motors and drives. The Louis Allis Co.

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**Internally-Geared Motors**—Illustrated 16-pp Bulletin F-1880 describes a line of internally-geared motors, in single, double and triple-reduction as well as right-angle worm-gear motors. Totally-enclosed and explosion-proof gearmotors are described. U. S. Electrical Motors Inc.

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**Variable Speed Drives**—Six-pp Folder 2874 describes constant horsepower variable speed drives to meet capacity demands to 50 hp and ratios to 5.5:1. Discusses features of a twin-strand single roll chain that operates between a pair of smooth facing wheels to change ratio and output shaft speed as effective diameter of wheel faces is altered. Link-Belt Co.

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**Magnetic Drives**—Performance data on magnetic drives designed to provide overload protection even under extended full stall are presented in 12-pp Bulletin TP 1-60. Drive fea-

tures are described, typical application illustrated, and engineering selection detailed. Tormag Products, Div., Gleason Reel Corp.
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**Screw Conveyor Drives**—Bulletin 7106 presents 20 pp of data on screw conveyor drives for applications in range from ½ to 30 hp, in four ratios, designed to bolt to standard trough ends. Design features and accessories are described, selection and dimensional data included. The Falk Corp.
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**V-Belt Drives**—Tips on getting the most from your V-belt drives are presented in 12-pp Bulletin DH-833. Benefits of a good maintenance program are detailed, and sections on selecting V-belts, installing V-belts, drive inspection and maintenance, and V-belt drive analysis chart included. The Gates Rubber Co.
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**Variable Speed Belts**—Detailed information on company's variable speed belts made with arched construction for improved transverse rigidity is presented in Product Bulletin 862. The Goodyear Tire & Rubber Co.
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**Anti-Friction Bearings**—Catalog 424-B covering "the broadest line in the anti-friction field," is an 8-pp folder giving capsule presentation of company's entire product line. A brief description of each product is provided. SKF Industries, Inc.
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**Filled Teflon Bearings** — Technical Bulletin CP-558 describes filled Teflon bearings designed for use as radial bearings on vertical pumps. Characteristics of filled Teflon bearing materials are discussed. Chemical & Power Products, Inc.
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**More Flexible Couplings**—An expanded line of Para-flex cushion couplings, from fractional to 190 hp per 100 rpm, is described in 12-pp Bulletin A669C. Of two new sizes included in the line is one capable of delivering 2000 hp at 1080 rph. Photos, drawing and text explain design features and operating characteristics of Para-flex. Dodge Mfg. Corp.
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**Flexible Couplings** — Comprehensive selection data on flexible couplings is presented in 48-pp Engineering Catalog 60. Misalignment is described and basic coupling arrangements and load classifications are included, along with photos of couplings, etc. Thomas Flexible Coupling Co.
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**Coupling Data**—An integrated selection of product bulletins and data on company's line of couplings for a variety of industrial applications is presented in this handy ringbound notebook. The notebook contains sections on product literature, engineering data, instruction sheets, application data, and price lists. To all of these sections, additional material can be added as it becomes available. Koppers Co., Inc.
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# We bet millions on our couplings

When you buy a Fast's coupling, you can bet your bottom dollar everything was built on the spot, not assembled piece by piece from other suppliers. Koppers multi-million dollar manufacturing facilities are the most modern in the industry . . . with advanced program machines, highly accurate gear shapers, a complete forge shop.

For example, all Fast's Couplings are jig-drilled and jig-reamed for greater interchangeability of parts. Result: you get high-quality, smooth-running, long-lived units that are the choice of more equipment manufacturers than any other gear-type coupling.
KOPPERS COMPANY, INC., 1011 Scott Street, Baltimore 3, Md.

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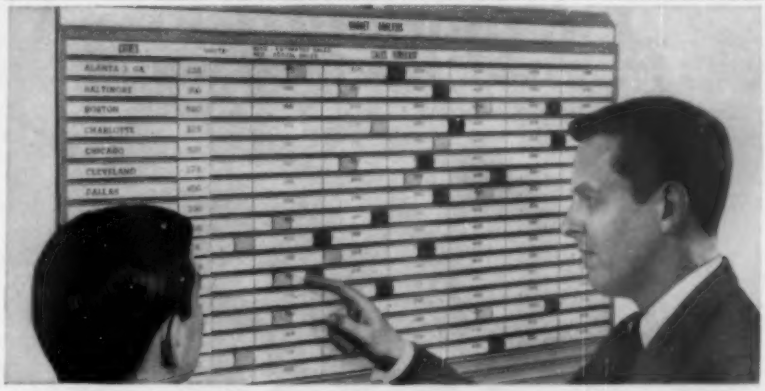

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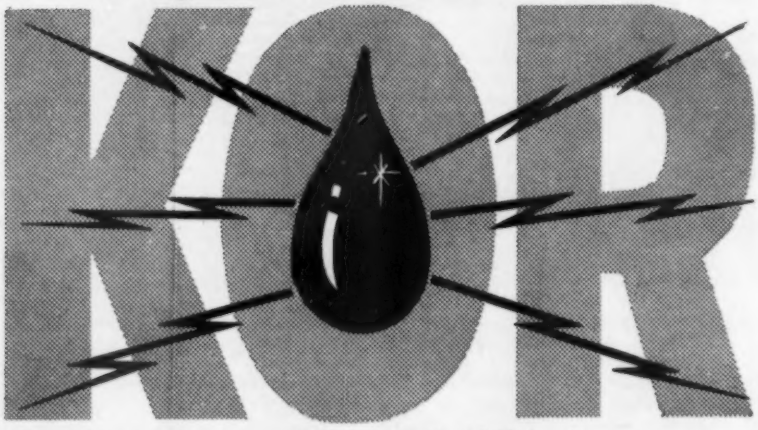


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# DATA FILE

(Begins on page 260)

## CONSTRUCTION

**Steel Buildings**—Advantages of building with steel are illustrated and described in colorful 12-pp Catalog B-16359. Various types of building constructions are illustrated, and details of construction shown, along with dimensional data. Armco Drainage & Metal Products, Inc.
▲ For a copy, circle 407 on Post Card

**Screw Fastening of Aluminum**—This 48-pp technical handbook covers various types of standard and special fasteners and fastening systems used to join aluminum assemblies. Supplemented with numerous illustrations and tables, it includes list of manufacturers of special screw fasteners and recommended hole sizes for various screws. Reynolds Metals Co.
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**Aluminum Sash**—Illustrated and described in this product sheet is rigid welded sash made from aluminum extrusions. Advantages are listed and sectional details pictured. Aluma-Sash Corp.
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**Decorative Protective Panels** — Advantages of Security Panel, a combination of steel mesh and polyester resin translucent panels are detailed in this bulletin. It features high dimensional stability, high impact strength and protective functions. Installation and technical information are covered. Resolite Corp.
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**Functional Glass** — Advantages of company's rolled, figured and wired glass for vertical sidewall and skylight glazing are detailed in Catalog 60-G, 20-pp. Describes types suited for commercial, institutional, industrial applications. Provides properties. Mississippi Glass Co.
▲ For a copy, circle 411 on Post Card

**Acrylic Plastic Sheet** — This 12-pp Booklet PL-415 describes properties and characteristics of Plexiglas acrylic plastic sheet. Applications in a variety of industries are illustrated. Rohm & Haas Co.
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You'll find two postage-free Reader Service Cards on pages 255-256. Use them for ordering equipment details — just circle item numbers of equipment you would like to know more about. You may also use the cards for requesting advertised catalogs.

**Basic-Roofing Information**—"What You Should Know About Your Roof" is a 40-pp clearly illustrated booklet which tells what makes a roof fail, how to recognize signs of roof deterioration, what to do to keep a roof in good condition. Discusses roofing practices. Johns-Manville.
▲ For a copy, circle 413 on Post Card

**Automatic Door Assemblies**—Eight-ppCatalog 171 describes features and advantages of company's automatic industrial doors and assemblies. Photos of typical installations and sectional diagrams showing details of operation and design are included. Clark Door Co., Inc.
▲ For a copy, circle 415 on Post Card

Postage-free cards for ordering catalogs are on page 256. You may also use the cards to order literature mentioned in the ads.

**Floor Surfacing**—Described in product bulletin is a copolymerized floor surfacing claiming superior tensile, flexural, bond and compressive strength. Detailed specifications and photos of typical applications are included. The Master Mechanics Co.
▲ For a copy, circle 416 on Post Card

**Corrosion-Proof Flooring**—Bulletin 120-A describes a monolithic corrosion-proof flooring material developed for application over concrete to protect against acids, alkalis and solvents. The Ceilcote Co., Inc.
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**Non-Slip Flooring**—Algrip, an abrasive rolled steel floor plate described as non-slip even on steel inclines, is the subject of Booklet AL-29, 8-pp. Discusses safety features. Alan Wood Steel Co.
▲ For a copy, circle 418 on Post Card

**Gratings and Treads**—Bulletin 1110, 24-pp, describes welded, serrated, pressure-locked, steel, vault, platform and aluminum grating in standard and close spacing types. Stair treads are also shown. Provides tread weights, and ordering instructions. Safe loads also given. Dravo Corp.
▲ For a copy, circle 419 on Post Card

**Stair Treads, Grating**—Details on company's aluminum stair treads and grating featuring one-piece construction are presented in this product bulletin. Describes types of finishes, sizes and weights available, and includes specifications. Aluminum Co. of America.
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**Safety Plate**—Rolled-steel flooring material for safe footing in plants and on products is featured in this 12-pp product bulletin. Typical installations are illustrated and details on installation methods are included. Inland Steel Co.
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## STORAGE, SHOP EQUIPMENT

**Guide to Shelving**—To assist plant engineers in selecting proper shelving for all storage requirements. 64-pp


LAST 3 TIMES LONGER, PUMPING ABRASIVE LIQUIDS

Left to right are shown: R. W. Delaney, General Foreman of Maintenance of the Westinghouse Mansfield plant; C. N. Greene, Tuller Corporation, Columbus, Ohio and W. O. Hale, Paint Lab. Foreman of Westinghouse, inspecting one of two rows of Viking paint pumps.

**WESTINGHOUSE** Electric Corporation's major appliance plant at Mansfield, Ohio has materially reduced the problem of pumping abrasive type coating materials, according to Mr. C. Reining, Manager, Works Engineering. **VIKING'S** new abrasive liquid **PUMPS** are the answer, working 24 hours a day, 7 days a week. These new pumps are lasting three times longer than any previous equipment and still going strong. Pressures range from 45 to 95 PSI. Of the 28 **VIKING PUMPS** handling paints, primers and finish coatings in the Westinghouse Mansfield plant, 12 are the latest type of **VIKING** abrasive liquid construction. The other 16 will be replaced with new type **VIKINGS.**

Have an abrasive liquid pumping problem at your plant? Profit by this Westinghouse experience! Install new **VIKING PUMPS,** with ceramic bearings and mechanical seals, especially designed to handle abrasive* liquids and provide long pump life. When writing please give this information: 1. Liquid pumped, 2. Viscosity of liquid (SSU), 3. Percentage and type of solids present in liquid, 4. Temperature of liquid, 5. Specific gravity, 6. Capacity of pump, 7. Suction lift or head, 8. Discharge pressure . . . and ask for bulletin SP-507Z. **VIKING PUMP COMPANY,** Cedar Falls, Iowa, U.S.A. In Canada, it's **"ROTO-KING" PUMPS.** (*Consult factory for recommendations on pumping abrasive liquids other than paints and inks.) See Our Catalog in Sweet's Plant Engineer's File.

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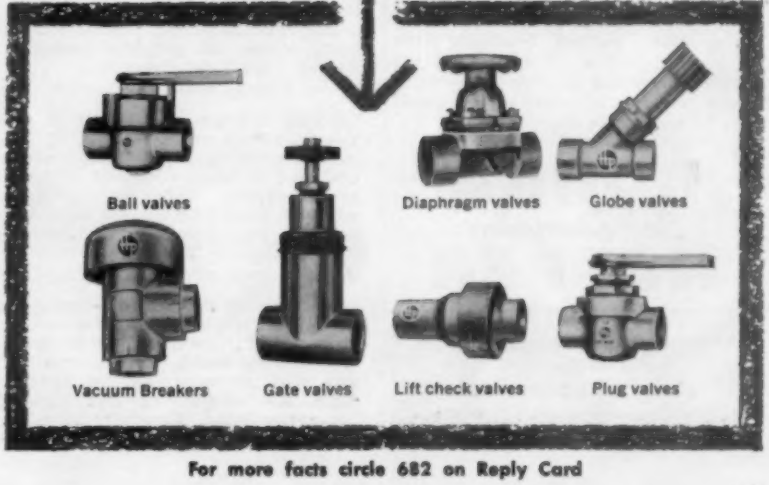
NOW
7 TYPES OF VALVES TO FIGHT CORROSION

With the introduction of a line of ball valves, Tube Turns Plastics now makes available a total of 7 different UPVC valves for corrosive services. Some are also available in "Penton" (chlorinated polyether) for higher temperatures. All are made for socket, threaded or flange connections in a range of sizes, and are available from your nearby TTP distributor. For details, write TUBE TURNS PLASTICS, INC., Dept. PE-11, 2929 Magazine Street, Louisville 1, Kentucky.

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# CAN CUT HANDLING COSTS 50%

With this self-dumping hopper on your lift truck, one man can do the work of two—in a fraction of the usual time. It's the modern, low-cost way to handle scrap metal, small castings, cinders, punch press parts, hot forgings, cullet—all kinds of bulk material.

Attaches in seconds to any lift truck—fork or platform. Can't slip off. Operator picks up loaded Hopper—transports it to its destination—releases the latch—and the Hopper automatically dumps its load, rights itself, locks itself.

Roura Hoppers are sturdily made of 3/16" steel plate with continuous arc-welded seams. Heavier plate if desired, also stainless steel or galvanized. Made in eight sizes, ¼ to 4 yard capacities, mounted on live skids or a choice of wheels. Standard models available for immediate shipment.

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**WANT MORE DETAILS?** Just clip this coupon to your letterhead and mail to
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1413 Woodland Ave., Detroit 11, Michigan


# DATA FILE

(Begins on page 260)

Catalog 30 offers detailed suggestions for correct shelving and storing materials, loose and packed parts. Storage cabinets are also described and instructions included for planning of stockrooms. Deluxe Metal Products Co., Royal Metal Mfg. Co.
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**Flexible Steel Shelving**—Advantages of Erectomatic steel shelving are illustrated and described in 8-pp Form 2451-D. Various types of shelving available are shown and dimensional data given. Columbia-Hallowell Div., Standard Pressed Steel Co.
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**Steel Equipment**—Catalog 100 H contains 92-pp of detailed information on steel cabinets, folding chairs, work benches, tool stands, shelving, tool storage, lockers, coat racks, filing cabinets, revolving bins, others. Includes dimensions and specifications. Lyon Metal Products, Inc.
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## HOSE, FITTINGS

**Hose and Fittings**—Comprehensive data on hose and hose assemblies, brass and steel tube fittings, hose and tube working tools, stock cabinets, hose racks and other specialty products are presented in 218-pp Catalog C-300. Profusely illustrated, it contains hose selector chart, assembly data chart, detailed specifications, technical data, application and installation instructions. Available to qualified plant engineers. The Weatherhead Co.
▲ For a copy, circle 425 on Post Card

**Teflon Hose Assembly**—Advantages of company's Springfield 120 Teflon hose assembly are detailed in this illustrated bulletin. Assembly procedure is pictured and described and design specifications tabulated. Titeflex, Inc.
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## MAINTENANCE

**Painting Economy**—This 12-pp guide to economical maintenance painting is designed to help reduce cost of painting in industrial, institutional and commercial buildings. Outlines three basic areas of painting economy. Barreled Sunlight Paint Co.
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**Coating Systems**—Described in this 16-pp bulletin are a number of protective maintenance coating systems designed to solve a variety of corrosive problems. Index tab indicates where a particular system should be applied ,and copy explains features of each system. The Glidden Co.
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**Steel Surface Protection**—Described in this bulletin are properties and advantages of Dimetcote 3, an inorganic zinc coating which "cold galvanizes" any steel surface. Typical applications are illustrated and general properties listed. Amercoat Corp.
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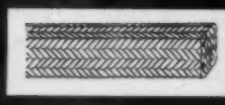
NEW
**PALMETTO®**
Teflon* Filament
Packing.



*for service with strong acids, corrosive fluids, solvents*

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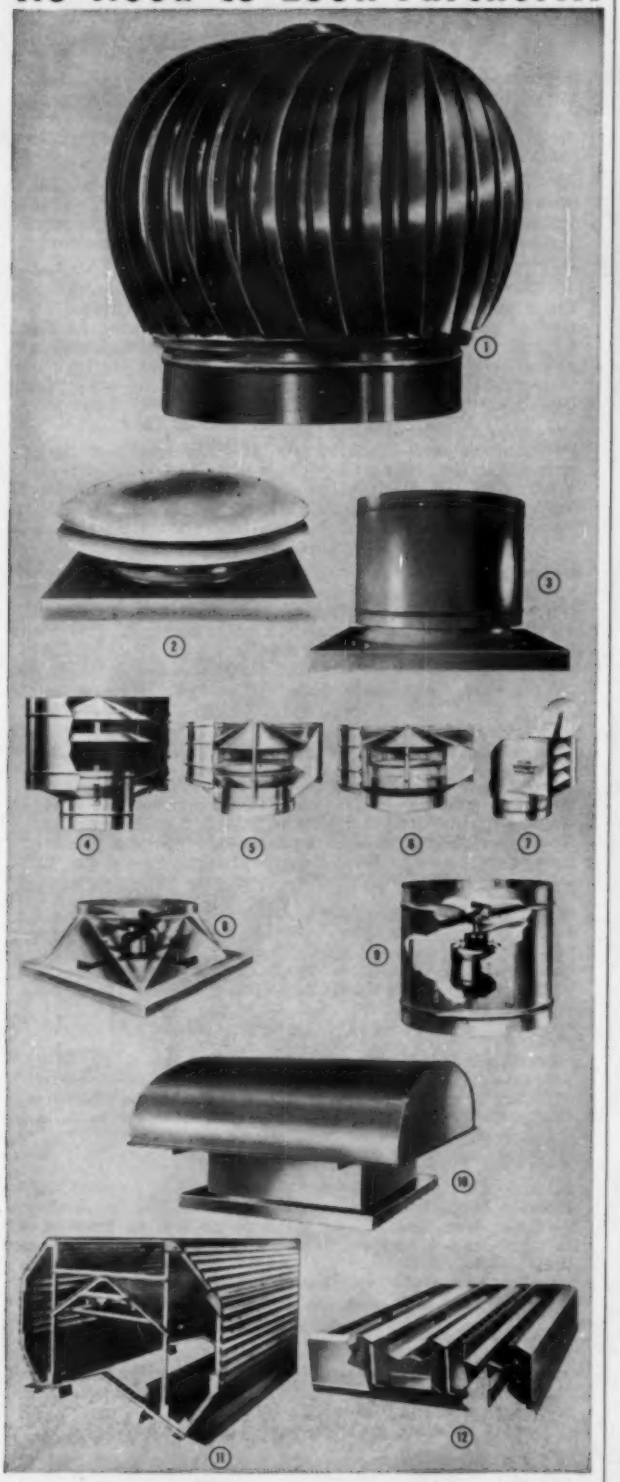

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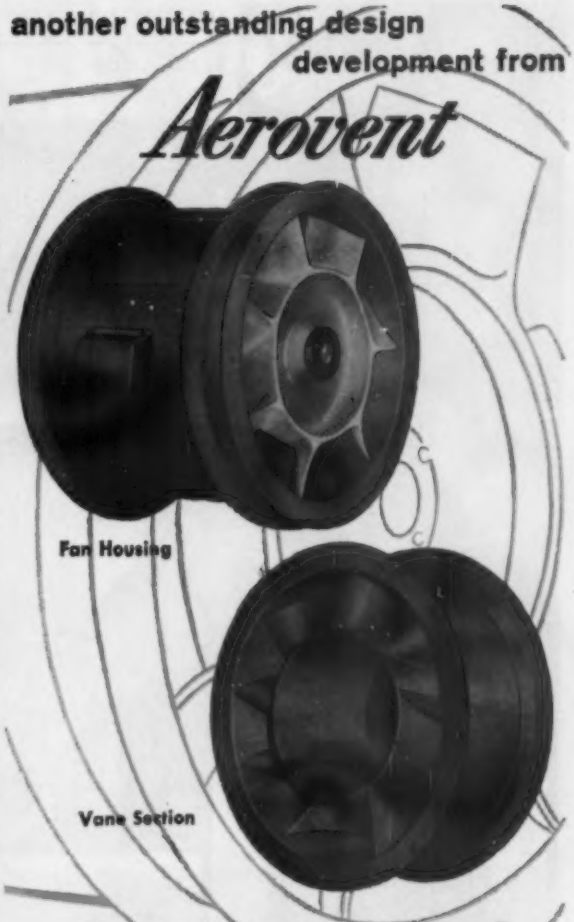


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**with removable vane sections**

Engineered for high-pressure, high-velocity air distribution systems, these units feature a unique removable vane section which simplifies installation and permits easy access for routine cleaning and maintenance.

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**MOVING AIR IS OUR BUSINESS®**

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# DATA FILE

(Begins on page 260)

**Insulation Coating**—This 32-pp illustrated handbook, Form L-17, presents the advantages of company's No-Drip insulation coating for preventing condensation drip from metal, concrete, brick, wood, plaster, or composition surfaces. Mortell Co.

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**Steam Cleaners**—This 12-pp catalog illustrates and describes steam cleaners and hydraulic pressure combination cleaning systems. Detailed specifications on each model included. Malsbary Mfg. Co.

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**Floor Maintenance**—Many types of industrial floors are studied and their soil removal problem analyzed in this 8-pp booklet, complete with charts, list of cleaning compounds, and descriptions of cleaning methods. Methods of sanitizing, stripping wax and paint, and of absorbing liquids told. Oakite Products, Inc.

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**Pyramid Ladders**—Catalog 158, 20-pp, describes a line of pyramid-design step ladders, as well as hydraulic lifts and fixed or adjustable-level work platforms for above-floor working safety. Illustrates 35 new models of ladders for working heights up to 15 ft. Ballymore Co.

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**Overhead Maintenance**—Bulletin G-205RR, 8-pp, tells how to control costs when maintenance goes above arm's reach—for painting and cleaning, electrical work, etc. Pictures a variety of scaffolding arrangements. Provides brief product information on steel and aluminum scaffolding, ladders. The Patent Scaffolding Co., Inc.

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## SLINGS, CHAINS, WIRE ROPE AND FITTINGS

**Wire Rope Requirements**—General wire rope recommendations for equipment most commonly used by a wide variety of industries are listed in Service Bulletin 107. Gives constructions most suitable for specific types of equipment. Leschen Wire Rope Div., H. K. Porter Co., Inc.

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**Wire Rope and Slings**—Abuses that shorten the life of wire rope and slings are graphically described in this 28-pp handbook. Abuses and correct uses are interestingly illustrated with cartoon caricatures and the booklet is packed with a wealth of rope and sling saving information. Union Wire Rope Corp.

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**Sling Chain Handbook**—Illustrated Data Book 100, 32-pp, presents "how to do it" information on sling chains—from ordering to care, use and inspection. Contains diagrams, charts and tables on standard and special styles of the sling chains. Columbus McKinnon Corp.

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**Sling Chain Assemblies**—Bulletin CSA-1 describes on "customized" components for assembling sling assemblies to suit requirements. Tells steps to follow in making a chain assembly and provides assembly chart giving load limits, chain, hooks, etc. Photos illustrate use of Wedglok coupling link assembly. Campbell Chain Co.

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**Wire Rope Slings**—Advantages offered by company's cable-laid slings are detailed in Bulletin DH-532-B. Stresses flexibility, strength, kink-free construction, and includes table of sling capacities. American Chain Div., American Chain & Cable Co., Inc.

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**Wire Rope Manual**—"Inspection of Wire Rope," "Methods of Lubricating Wire Rope," "Use and Abuse of Wire Rope," and "Sheave Maintenance" are among subjects covered in this 188-pp Wire Rope Manual, Catalog G-16. In addition, there are sections devoted to strengths and weights of wire rope, cable assemblies, and rated capacity of slings. Manual is available to qualified plant engineers. Macwhyte Wire Rope Co.

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SAY WHAT THEY DO

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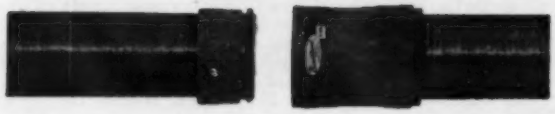

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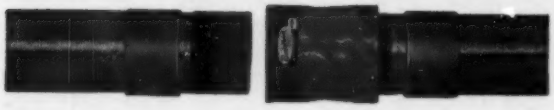

. . . strong as steel pipe, only one-eighth the weight. Tensile: hoop 80,000 psi, longitudinal 40,000. Highly corrosion resistant. Won't scale, cold flow or deform. 20-foot lengths easy to cut and join; threaded or locking wedge fittings.

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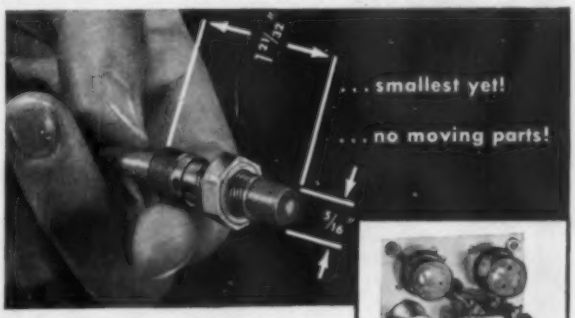


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Canada: Atlas Instrument, Ltd., Toronto

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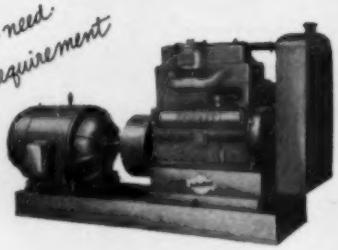
CHECK THESE 6 WAYS SCHRAMM COMPRESSORS SAVE REAL MONEY

1 they're a complete package

everything you need for any air requirement in one unit!



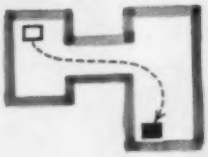
2 they're compact

go anywhere in minimum space

in odd corners

overhead

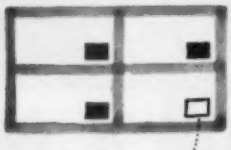
3 they're easy to move



transfer anytime to meet changing needs

4 they fit a unit system

buy only the Schramm compressors you need



add units as you expand

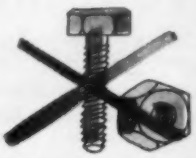
5 they need no elaborate foundation

just put a Schramm in any floor space

save cost of reinforcing the floor

6 they have no vibration

buildings and floors don't shake all day



you don't even have to bolt a Schramm to the floor

Schramm Stationary Compressors are electric motor or V-belt driven . . . 50 to 600 cfm. Write today for copy of Bulletin SSB-59.

Schramm

AIR COMPRESSORS

665 North Garfield Ave., West Chester, Pa.

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# DATA FILE

(Begins on page 260)

**Drop Forged Fittings**—Comprehensive data on company's line of drop forge fittings for wire rope and chain are presented in 40-pp Catalog 950-2. Includes specifications, dimensions, rated capacities and weights. Crosby-Laughlin Div., American Hoist and Derrick Co.

For a copy, circle 441 on Post Card

## MATERIALS HANDLING

**Continuous Power Conveyor**—Featured in 64-pp Catalog A-93-R is a continuous power conveyor designed to meet the requirements for handling continuous production items. Component parts of the system, including track, chain, and suspension components, are fully illustrated and described. Installations are illustrated. Richards-Wilcox Mfg. Co.

For a copy, circle 442 on Post Card

**Conveyor Chains**—This 38-pp engineering reference book contains comprehensive information on selection of chain for conveying and elevating. Correct application of chains to conveyor systems, development of attachments to increase their versatility and factors in selecting chains are outlined and illustrated; and comparison tables, installation tips, maintenance pointers and a trouble shooting chart included. Moline Malleable Iron Co.

For a copy, circle 443 on Post Card

**Custom Cranes**—Twelve-pp Bulletin 5000-B describes and illustrates electric and hand operated overhead traveling cranes, jib cranes, hand hoists, I-beam trolleys, and special crane-type equipment. Covers in particular detail custom-engineered overhead electric traveling crane bridges and electric trolley hoists, available in a wide range of capacities, speeds and spans. Conco Engineering Works.

For a copy, circle 444 on Post Card

**For Overhead Handling**—Illustrated and described in 20-pp Bulletin 15005 are Load Lifter cranes ranging from small capacity single girder crane bridges for use with hand operated chain blocks or electric hoists to large capacity double girder cranes with hand operated cable type hoists, including full revolving jib cranes. Specifications, capacities. Manning, Maxwell & Moore, Inc.

For a copy, circle 445 on Post Card

**Electric Hoists**—Twelve-pp Bulletin DH 133D describes Speedway electric hoists of 500-to 4000-lb capacities. Fully illustrates and explains design features and gives details on suspensions and conducting systems. Clearance data given. Wright Hoist Div., American Chain & Cable Co., Inc.

For a copy, circle 446 on Post Card

**Electric Hoists**—Six-pp illustrated Bulletin 905 describes R&M Type J electric wire rope hoists in capacities of ¼, ½, 1 and 2 tons. Shows complete specifications including mounting options and sectionals. Hoist & Crane Div., Robbins & Myers, Inc.

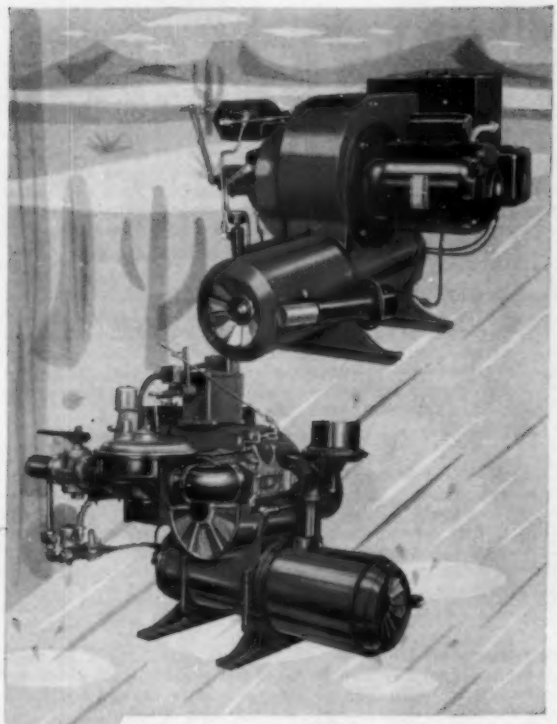
For a copy, circle 447 on Post Card

**Spur Gear Hoist**—Features and advantages of company's aluminum spur gear hoist which combines portability with speed are outlined in Product Bulletin ADH-80. Hoist and trolley specifications are included. Coffing Hoist Div., Duff-Norton Co.

For a copy, circle 448 on Post Card

**MH Equipment Selector**—Sixteen-pp Condensed Catalog 80-204 describes and illustrates manufacturer's line of materials handling equipment. Offers specifications and illustrations on rider fork lift trucks, rider tractors, narrow aisle rider electrics, electric powered walkies and manual equipment. A selector chart shows types. Lewis-Shepard Products Inc.

For a copy, circle 449 on Post Card



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## Perfect mixture of air and fuel gives perfect combustion in any weather

**HEV-E-OIL BURNERS** furnish *all* the air necessary for combustion. This assures perfect fire control regardless of the weather or draft conditions. *Exclusive* metering pump measures oil in proper proportion to air . . . assures highest possible efficiency and highest return from your fuel dollar. Once the burner is set, it *stays* that way rain or shine! Complete package! Fire tested! Meets all codes! Electronic controls! Models from 5 to 150 gph.

**HEV-E-DUTY POWER GAS BURNERS** also provide their own air supply — without the aid of chimney draft. Air is metered in correct proportion to the amount of gas being used. And like HEV-E-OIL BURNERS, minimum-low fire and maximum-high fire can be controlled exactly to assure top efficiency for each individual boiler or furnace installation. Set it! Forget it, no matter what the weather. Sizes from 720,000 to 21,000,000 Btu. Also combination gas/oil models. Write Dept. PE-110 for complete facts.

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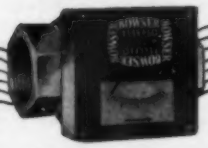

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BOWSER, Inc. Fort Wayne, Ind.

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you can get it to the second with . . .

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INSTITUTIONS

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Signal bells, buzzers, lights, etc. are dependably controlled with ZENITH units—proved in countless applications. Synchronous motor for accuracy...5-minute intervals in any 24-hour schedule ...easily changed...calendar cutout optional. *Write for bulletin.* See Classified Phone Directory for Name of Factory Rep.

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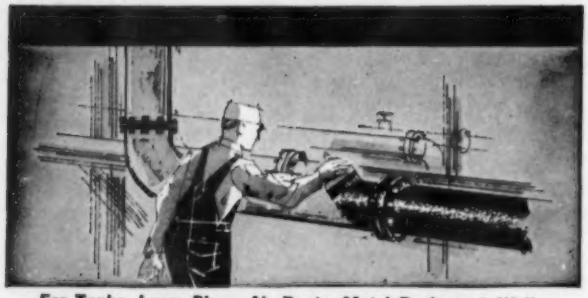

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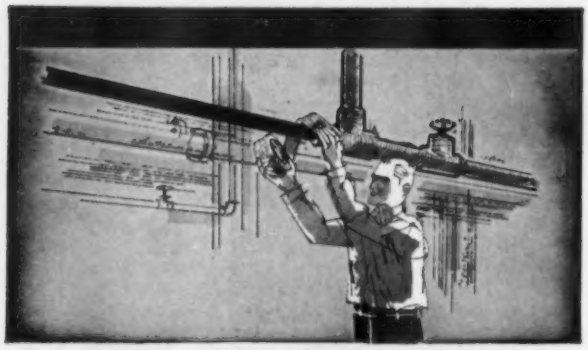
The heavy consistency of NoDrip outlasts many coats of paint or ordinary rust-preventives. Permanently insulates and protects. Applies easily with trowel, brush or special spray. Non-toxic, odorless and non-flammable. Resists acid, alkali, brine solutions or vapors. Available in 1, 5 and 55 gallon drums.



**For Smaller Pipes or Tubing, Permanently End Condensation Drip, Rust and Corrosion With NoDRIP TAPE**

An easy-to-use, wrap-around pipe covering, perfectly pliable, cork-filled, completely self-adhering. Forms an air-tight, 100% vapor- and moisture-proof jacket. Fits snugly even around tees, unions, angles, valves. Cuts maintenance costs—makes out-of-the-way storage areas useable—ends slip and slide floor hazards. No need for vapor seals, brads, fasteners or tools of any kind.

*At all leading hardware, mill supply and plumbing jobbers. For complete information and technical handbook, write*

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**For more facts circle 696 on Reply Card**


# DATA FILE

(Begins on page 260)

**For Materials Handling**—Specifications and illustrations on two-wheel trucks, dollies, wagon trucks, platform and shelf trucks, and many styles of casters, jacks and semi-live skids are given in 12-pp Bulletin 59G. Also included are specifications on demountable rubber tired, plastic, and pneumatic wheels. Nutting Truck and Caster Co.

▲ For a copy, circle 450 on Post Card

**Cost-Cutting Materials Handling**—"The How Book of Cost-Cutting Materials Handling," is a 24-pp booklet covering various phases of the materials handling problem and their effect on industrial production. Text and pictures cover such subjects as fundamental handling motions, advantages of planned material handling practices. The Yale & Towne Mfg. Co.

▲ For a copy, circle 451 on Post Card

**Caster, Wheel Manual**—Featured in 192-pp Manual 65 is comprehensive information on company's complete line of casters, wheels, glides, desk shoes and accessories. Illustrated with photos and dimensional drawings and diagrams of the various types of casters, and wheels for a variety of applications, manual contains tabulated engineering data. Darnell Corp.

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**Self-Dumping Hoppers**—Cost-saving advantages of self-dumping steel hoppers for bulk material handling are detailed in Bulletin 265. Photos showing typical handling applications are included. Roura Iron Works, Inc.

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**Sheet and Coil-Lifters**—Bulletin SL-30, 16-pp, illustrates and describes various types of standard and semi-special lifters for one-man or automatic handling of sheet and coil stock. Advantages and design features are detailed. Cullen-Friestedt Co.

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## PROCESSING EQUIPMENT

**Industrial Equipment**—Catalog A-660, 12-pp, discusses finishing systems—specifically—spray, dip or flow coatings, cleaning, pickling, rust-proofing, hydro-filter spray booths, dip and flow coaters, drying and baking ovens, hydro-foam dust collectors and fog filters. The R. C. Mahon Co.

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**For Heat Processing**—Finishing systems, ovens and furnaces used in heat processing are featured in this 8-pp bulletin. Illustrations of various installations are included, along with descriptive and dimensional data. Despatch Oven Co.

▲ For a copy, circle 457 on Post Card

## TOOLS, WELDING AND MACHINE SHOP

**Power Tools**—Presented in this 64-pp 1960 catalog is manufacturer's line of power tools for industrial production, plant maintenance, construction, wood and metalworking and other uses. Saws and accessories, hammers, planes, routers, sanders, drills, drivers, wrenches, shears, polishers, grinders and abrasive products are included. Skil Corp.

▲ For a copy, circle 458 on Post Card

**Power Tools**—Catalog 1(J) contains 68-pp of comprehensive selection data on power tools, including belt sanders, bench grinders, buffers, chain saw attachment, cleaners, coal drills, die grinders, drills, drum vacuum cleaners, impact wrenches, planes, saws, sanders, screw drivers, and others. Includes detailed specifications. The Black & Decker Mfg. Co.

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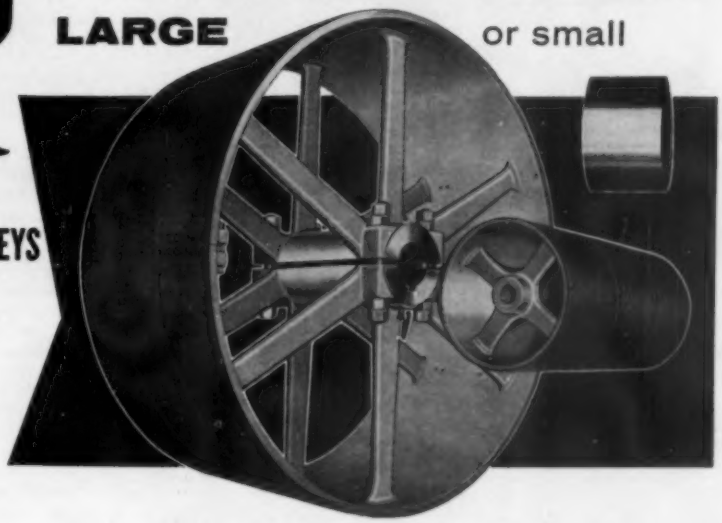
# PULLEYS THAT PERFORM ON THE JOB...

LARGE or small

EHRSAM

MICROMETAL CAST-IRON PULLEYS



There is no substitute for experience in producing cast-iron pulleys for use in our many modern industries. Today, after 88 years of experience, the Ehrsam Company is still continuing research to produce quality cast-iron pulleys.

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# SOUND warning

Sound warning is advice to be heeded!

Signals, audible or visual, are quicker in action, are universally recognized and initiate *instant response.*

The sound of a siren literally cries

*Danger—Emergency!*

The startling flash of the Beacon Ray, its companion signal, provokes the same reaction visually.

FEDERAL has pioneered in visual and audible warnings, the *very best signals* available.

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## The right stripper for upright surfaces

*NEW*

# Oakite VisStrip®

For stripping paint from the vertical surfaces of metal panels, walls, cabinets... there's nothing quite like the "grip-and-strip" action of new Oakite VisStrip.

Oakite VisStrip has just the right viscosity to cling tenaciously to vertical and underside surfaces... to loosen the grip of such resistant finishes as epoxies, acrylics, vinyls, polyesters... to set these finishes up for easy removal by pressure rinse.

Oakite VisStrip covers quickly, smoothly with brush or swab. High viscosity is maintained over long periods of time. Service Report 55A gives complete details. Write Oakite Products, Inc., 31C Rector Street, New York 6, N. Y.

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SCIENCE

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Simple and economical to install . . . no duct-work operates independent of present heating system . . . complete range of sizes from 8,000 to 150,000 CFM . . . full modulating 25 to 1 turn-down ratio . . . factory flame-tested.
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The National Champion MA is a completely packaged unit designed for all makeup air requirements. 100% available operating efficiency provides economical operation and clean odorless combustion. DWDI wheels give quiet, smooth air movement regardless of static pressure changes within building.
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Infra-red comfort heating is new and different, but thousands of users testify to its low cost and complete satisfaction.

Panelbloc heats like the sun. It generates infra-red energy in the 4 to 12 Micron range, and directs these waves downward, warming anyone and anything in its range. Panelbloc warms floors, machines and people.

No moving parts, no fans or motors. No electrical connections needed. Automatic, clean and safe, Panelbloc carries AGA and UL approval.

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PANELBLOC DIVISION
THE BETTCHER MANUFACTURING CORP.
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# DATA FILE

(Begins on page 260)

**Industrial Tools**—Information on a complete line of industrial tools, including 500 new types and sizes never before offered, is presented in 120-pp Catalog 57. Included are complete lines of wrenches, socket wrenches, drop forged clamps, tool holders, set up and hold down tools, cutting tools provided. Armstrong Bros. Tool Co.

For a copy, circle 460 on Post Card

**Industrial Wrenches Hand Tools**—Tools for production lines, maintenance work and product servicing are presented in 156-pp Industrial Catalog 58-I. Loaded with pictures and tool facts, book describes in detail the complete line of over 4,000 tools—including chests and rollcabs, wrenches and sockets of all types, screwdrivers, pliers, pullers, etc. Snap-on Tools Corp.

For a copy, circle 461 on Post Card

**Fastening Tool** — Illustrated and described in Catalog Form B-141 is the Duo-Jobmaster—designed to handle the tough fastening jobs into steel or concrete. Features and advantages detailed. Ramset Div., Olin Mathieson Chemical Corp.

For a copy, circle 462 on Post Card

**Pipe Tools** — Ordering and application information on Rigid pipe tools is provided in 16-pp illustrated Catalog 7596R-6. Wrenches, cutters, threaders, reamers, vises, and others are pictured and described, also power drives. The Ridge Tool Co.

For a copy, circle 463 on Post Card

**Data for the Shop**—"Fluids and Facts for Metal Working" is a pocket-size booklet of about 44-pp. A section on metal working fluids covers their function and selection, preparation and use of soluble oil and paste compounds, and prevention of dermatitis. Conversion tables, steel numbering systems, machinability ratings. Standard Oil Co. (Ind.)

For a copy, circle 464 on Post Card

**Air Or Hydraulic Chucks**—Illustrated and described in 32-pp Catalog 300 Section 1 are air or hydraulic operated chucks with improved design features. Various types of chucks are covered, including two-jaw, three-jaw, dual purpose, compensating chucks, combination chucks and others, and dimensional diagrams and data are included. Logansport Machine Co.

For a copy, circle 465 on Post Card

## INSTRUMENTS, CONTROL

**Automatic Controls**—Selections and application information on a line of automatic controls for steam and water service is presented in this 46-pp Engineer's Manual. Covers controls for fuel oil heaters, heat exchangers for cooling, instantaneous heat exchangers, jacket water cooling, process hot water, pressure reducing. The Powers Regulator Co.

For a copy, circle 466 on Post Card

**Automatic Control Equipment** — Detailed information, technical data and prices on all types of automatic electrical control equipment is featured in 64-pp Catalog 18. Applications, construction details, engineering information and operating features are included, as well as general data and design specifications. Indexed in four sections, covers automatic transfer switches, contactors, special controls and timing devices. Zenith Electric Co.

For a copy, circle 467 on Post Card

**Explosion-Proof Controls**—Advantages of company's explosion-proof controls, indicating, non-indicating and recording, are detailed in this product bulletin. Design features and ratings given. The Partlow Corp.

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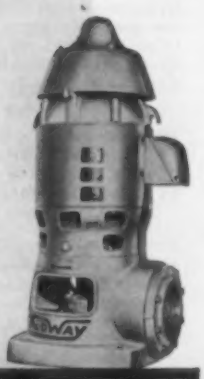
**Valve Attenuator**—Bulletin K-45 describes a valve attenuator for direct pneumatic activation of valves and

VERTICAL TURBINE PUMPS

FLOWAY

# Know How Much WATER This Takes?

Here is a critical cooling job. Oceans of water must be pumped to absorb the enormous heat generated at blast-off. By comparison the usual industrial cooling job seems relatively easy, yet no matter what its purpose, cooling is always vital. You need good pumps . . pumps that are engineered and built to do the job. FloWay pumps are working effectively in cooling installations throughout the world. Send for bulletin #14 describing FloWay pumps for every industrial need.



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Oakland, California — Pacific Pumping Company
San Francisco, California — Woodin & Little
Denver, Colorado — Harry J. Glass & Associates
Oakland Park, Florida — Peninsular Armature Works
Metarie, Louisiana — A. G. Kirkwood Co.
Detroit, Michigan — Detroit Air Compressor
Baltimore, Maryland — R. Thum & Company
Buffalo, New York — Ralph Simmons & Company
New York, New York — Frank A. Kristal
Cleveland, Ohio — W. J. Bryson Company
Tulsa, Oklahoma — The Kane Company
Portland, Oregon — Pacific Pumping Company
Ardmore, Pennsylvania — Warren E. Quillman
Pittsburgh, Pennsylvania — Weinman Pump & Supply Co.
Dallas, Texas — Livingston Machinery Co.
Houston, Texas — Pump & Power Engineering Co.
Seattle, Washington — Pacific Pumping Company

FLOWAY Pumps

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# DEGREES

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Get the heaviest duty wearing surface for foot and wheel traffic with these Flintkote Flooring Products —all are trowel finished. • Asphalt Mastic Flooring (FLINTMASTIC†) • Latex Industrial Flooring • Epoxy Flooring—for problem floors.

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# DATA FILE

(Begins on page 260)

controls in dual duct constant volume high velocity air distribution systems. Performance data, dimensions and specifications included. Connor Engineering Corp.

For a copy, circle 469 on Post Card

## OTHER EQUIPMENT

**Industrial Stack**—Detailed information on a permanent, low cost refractory smoke stack for commercial and industrial applications is contained in 8-pp Bulletin IS-32. Gives product information, applications with boilers, furnaces, etc. VanPacker Co., Div., The Flinkote Co.

For a copy, circle 471 on Post Card

**For Cleaner Furnace**—The use and application of Oxi Crystals to keep furnaces and the fireside of boilers free of slag, encrusted carbon, soot and fire-scale is described in a recent pamphlet. Oxi-Kor Corp.

For a copy, circle 472 on Post Card

**Product Guide**—This 26-pp booklet is designed to show the wide range of products manufactured by the Company. It contains an alphabetical listing of the products, with reference to engineering literature available. Allis-Chalmers Mfg. Co.

For a copy, circle 473 on Post Card

**Industrial Equipment**—Featured in this 5-pp Bulletin is a line of equipment manufactured by this company, including such items as air release, can filters, capacitors, circulating lubrication systems, rate of flow controllers, dispensing outfits, filters, indicators, lubricating units, meters, oilers, pumps, valves. Bowser, Inc.

For a copy, circle 474 on Post Card

**Automatic Air Products**—Featured in 22-pp Bulletin 157 are automatic air products, including separators, after-driers, filtrators, filters, line drains, governors and kits, combinations, regulators, and lubricators. Advantages are detailed and operation described. Wilkerson Corp.

For a copy, circle 475 on Post Card

**Mechanical Press Brakes**—Performance and construction features of company's all-welded mechanical press brakes for forming and punching work of every description are detailed in 48-pp Catalog 2023A. Clearances, dimensions and specifications, and tonnage requirement tables included. The Cleveland Crane & Engineering Co.

For a copy, circle 476 on Post Card

**Vertical Transportation**—Selection of vertical transportation for every traffic-moving job is detailed in 32-pp Bulletin A-382. Various types of elevators and escalators for a variety of commercial and industrial applications are described. Otis Elevator Co.

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**Glass-Bag Filters**—Features and advantages of glass-bag filters for cleaning hot, corrosive gases are illustrated and described in 12-pp Bulletin 806. Typical installations are illustrated and methods of cleaning bags covered. Dracco Div., Fuller Co.

For a copy, circle 478 on Post Card

**Product Directory**—Product Directory G-103 covers company's divisions and products. Products are divided into major sub-groups—chain link fence, chemicals and coke, springs, belts, wire, wire cloth, etc. Brand names are given, as well as applicable reference literature. The Colorado Fuel and Iron Corp.

For a copy, circle 479 on Post Card

**Nickel-Chromium Alloy**—Detailed information is contained in Technical Bulletin T-38, 36-pp, on Inconel X, an age-hardenable nickel-chromium alloy. Physical and mechanical properties, applications, specifications, available forms, and design data are given with graphs. Huntington Alloy Products Div., The International Nickel Co., Inc.

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Handling Coil

CHECK THESE
C-F
Lifter
ADVANTAGES

- 1 Lifter handles wide range of coil sizes
- Requires minimum of only 10" to 12" between piles — saves storage room
- 1 man operation—eliminates hookers
- Positive grip on coil—no damage to material

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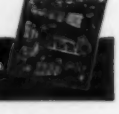

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**Corrosion Control Tips**—Control of water problems in air conditioning system—scale formation and slime and algae growths—is discussed in Bulletin 596. Offers suggestions for the control of these problems through adequate, planned chemical treatment. Application information as well as control testing data are included. Betz Laboratories, Inc.

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**Data on Demineralizing**—Detailed information on the process of demineralization is presented in this 36-pp Handbook on Demineralizing, Publication 5800-E. Includes sections on definition of terms, building the demineralizer system, demineralizer operations, and case histories of typical installations. Cochrane Corp.

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**Electrical Insulating Oils**—Bulletin 58, 6-pp, gives technical information on insulating oils for transformers and cables. Discusses functions of a transformer oil; gassing characteristics of oils, properties of electrical oils, uses for inhibited and uninhibited oils. Information on cable oils includes discussion of requirements for three basic types of cables; viscosity-temperature relationships of oils. Sun Oil Co.

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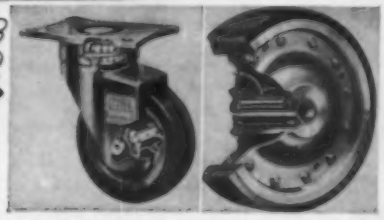

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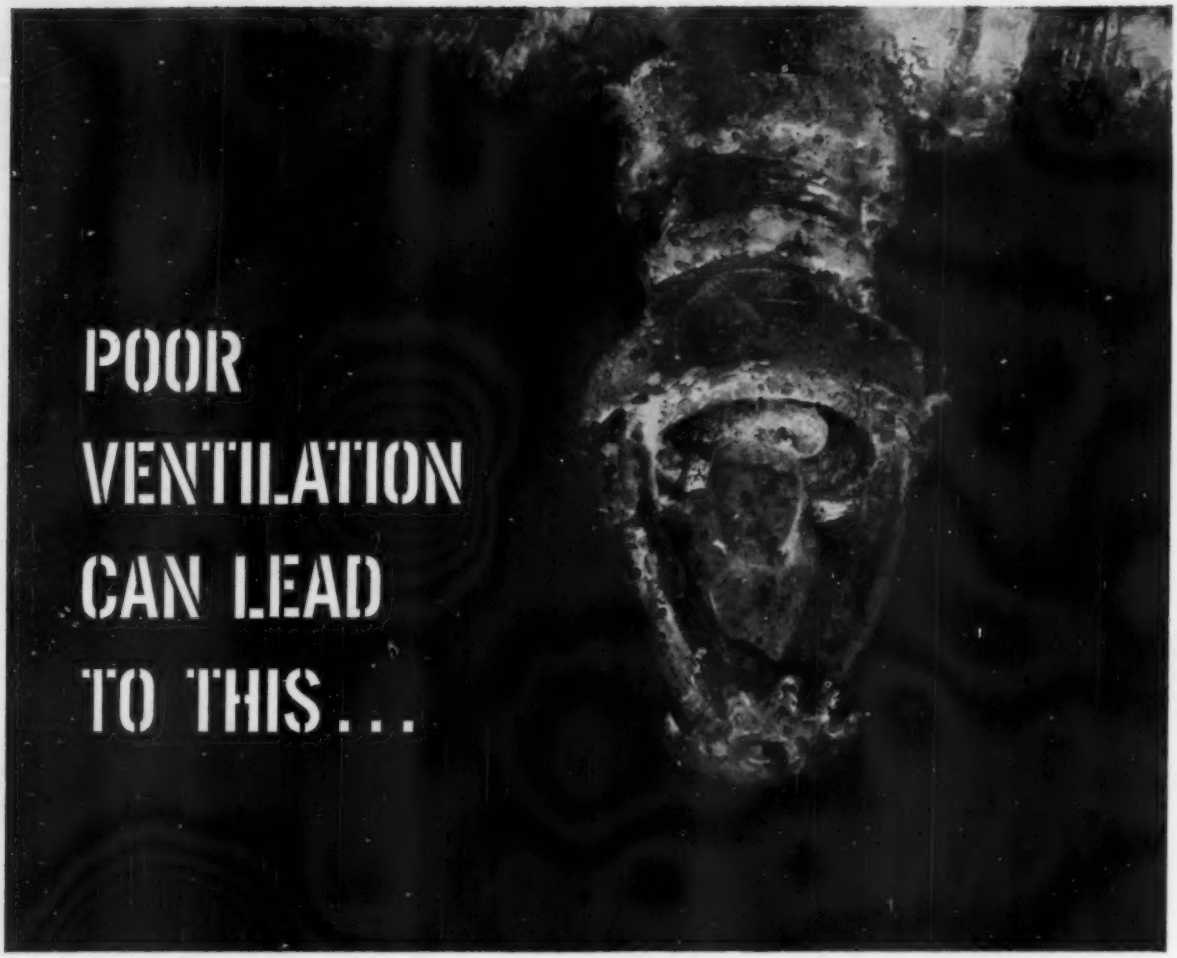


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